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1949

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FOREWORD

The year 1949 marks the close of a dynamic half century. This period has been one of amazing development in the minerals and metals industry—during the last 50 years the United States has achieved preeminence among the nations of the world in producing, processing, and fabricating mineral raw materials.

This volume of MINERALS YEARBOOK for 1949 appears at an opportune time. Today we have reached a position where we must reappraise and reevaluate our ability to produce for the future. In the current unsettled state of the world, the problems before our minerals industry are complex, and their solution appears at this time to be uncertain. There is no doubt that the requirements of the immediate future will necessitate expanded production and increased exploration for new sources of mineral raw materials within the continental limits of the United States and its territorial possessions as well as within the confines of free nations overseas.

It is to be hoped that the 1949 MINERALS YEARBOOK will be studied carefully not only by those directly concerned with the problems of the mineral industry but also by members of the general public who are thinking ahead. Whether or not the United States has reached the apex of its production potential will depend upon good understanding of our mineral position by the American people as well as the initiative, abilities, and enterprise of industry and government. Those who consult this volume cannot fail to appreciate the complexities of an industrial economy and the productive capacity of the American mining industry that is so necessary for the welfare and security of the United States and a free world.

Again I wish to extend to the minerals industries the thanks of the Bureau of Mines staff for their continued cooperation in furnishing data for this volume. This valuable assistance has made it possible to present to the public an authoritative analysis of our Nation's mineral position.

JAMES BOYD, *Director*.

INTRODUCTION

This edition of MINERALS YEARBOOK was improved by revising the basis of the national mineral-production tables so that for 1947–49 they are on the same basis as the State tables (Statistical Summary chapter). Innovations include statistical tables showing the minerals produced in each country (Mineral Production of the World chapter), world production of lead and zinc on a mine basis, total mineral imports and exports of the United States (Review of Mineral Industries chapter), and the mineral production of United States Territories and possessions. The table of contents at the beginning of each chapter was omitted in recognition of the excellence of the index. The manuscript was completed 2 months earlier in the year than was the preceding edition.

A comprehensive check of the accuracy and consistency of the statistics in this volume was performed by John Hozik, assistant editor, aided by K. Joyce D'Amico and Vane N. L. Glendening. The manuscript was edited for style improvement, punctuation, and type specification by Mabel E. Winslow, assisted by Estelle R. Templeton and Anna B. Brown, of the Office of Minerals Reports. Most of the charts were drafted by Adelaide B. Palmer, of the MINERALS YEARBOOK section, and others were prepared under the supervision of Louis F. Perry, Region VIII, Pittsburgh, Pa.

Valued advice on the printing of MINERALS YEARBOOK continued to be given by John H. Ady, Chief of Publications of the United States Department of the Interior and liaison officer between the Department and the United States Government Printing Office.

The principal source of the information contained in this volume is questionnaires completed by many persons in the mineral industries. The significant supplementary data on foreign trade are from the United States Department of Commerce and on foreign production from the United States Department of State. Other information of value is quoted from business magazines, trade associations, scientific journals, and various Government agencies. The following officials cooperated with the Bureau of Mines in compiling production data for their respective States:

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Bureau of Mines statisticians and researchers who rendered substantial assistance to the authors of this volume include the following: In Washington, D. C.—Hope Anderson, Dorothy M. Burch, Emma A. Eastep, Leon W. Geyer, Roberta W. Grunberg, Marjorie Kahn, Naomi W. Kearney, James G. Kirby, Lena M. Lunsford, Ann C. Mahoney, Annie L. Marks, Edith D. McKinney, Zena M. Mohme, Betty M. Moore, Robert C. Morris, Elizabeth R. Parker, and Virginia E. Wrenn. In Juneau, Alaska—Opal Y. Sharman. In Los Angeles, Calif.—Edward T. Knudsen, Adele B. Esser, and Harry L. Scarborough. In San Francisco, Calif.—Leona C. Froehlich and Bettye Lanning. In Denver, Colo.—Helen G. Post and Florence H. Scott. In Salt Lake City, Utah—Alice K. Feltch, Virginia C. Halverson, and LaRu T. Shepherd.

ALLAN F. MATTHEWS.

FEBRUARY 1951.

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PART I. GENERAL REVIEWS

Review of the Mineral Industries in 1949

By Allan F. Matthews

PRODUCTION

Value of Production.—Mineral products mined and processed in the United States in 1949 were valued at 10.6 billion dollars, the second-largest output to date. This was 14 percent below the all-time high in 1948. Of the three major groups, fuels and metals declined 17 and 10 percent, respectively, whereas nonmetallic minerals (other than fuels) was virtually unchanged. The fuels in 1949 constituted 75 percent of the total, nonmetallic minerals 15 percent, and metals 10 percent.

The 14-percent decline in value of mineral output in 1949 compared with 1948 was sharper than the decreases in agricultural products (8 percent), all products combined (1 percent), and national income (3 percent). This divergence apparently was a compensation of the spurt by minerals in reaching its 1948 peak, for the output of minerals, all products combined, and national income in 1949 were almost uniformly 10 percent above 1947, although farm products were 6 percent below. The bases of these comparisons are Bureau of Agricultural Economics reports on cash receipts from farm marketings (28,127 million dollars in 1949 and 30,544 million dollars in 1948, excluding Government payments) and Bureau of Foreign and Domestic Commerce reports on gross national product (255.6 billion dollars in 1949 and 259.1 billion dollars in 1948) and national income (216.8 billion dollars in 1949 and 223.5 billion dollars in 1948).

The basis of calculating the total value of mineral production of the United States has been revised to agree with the State totals. The new series is shown in table 1 in the "as reported" columns. The revisions, described in detail in the Statistical Summary of Mineral Production chapter of this volume, are primarily the result of discarding component series measuring the value of mineral products at an advanced stage of processing and substituting series whose points of measurement are at the mine or concentrating mill. This substitution was carried as far as it was possible to go with existing

commodity canvasses. The remaining deficiencies are statistical series for mine values of the limestone, cement rock, and clay used in making cement; limestone for lime; dressed dimension stone (in part); natural-gas liquids; and the nonferrous metals—copper, zinc, lead, gold, silver, antimony, mercury, and tin. If estimates for these replace the cement, lime, dressed stone, natural-gasoline plant liquids, and smelted metals series in the "as reported" columns of table 1, the result is shown in the "adjusted" columns of that table. In other words, the "adjusted" columns are strictly on a mine basis. Data prior to 1947, on either of these new bases, have not yet been derived.

TABLE 1.—Mineral production of the United States, by major groups, 1947–49, in millions of dollars

Mineral group	As reported			Adjusted [1]		
	1947 [2]	1948 [2]	1949	1947	1948	1949
Fuels	7,181	9,495	7,886	7,161	9,472	7,861
Nonmetallics (except fuels)	1,345	1,559	1,567	965	1,085	1,077
Metals	1,084	1,219	1,101	906	1,026	932
Total	9,610	12,273	10,554	9,032	11,583	9,870

[1] Preliminary figures. [2] Revised figures.

Volume of Production.—The physical volume of production in 1949, compared with 1948, decreased 13 percent for minerals, 10 percent for durable manufactures, and 5 percent for nondurable manufactures, according to the Federal Reserve Board. During 1949 the Board's index of mineral production (1935–39=100) dropped from 149 in January to 112 in October and recovered to 141 in November. The annual average was 135 in 1949, compared with the records of 155 in 1948 and 162 in May 1948.

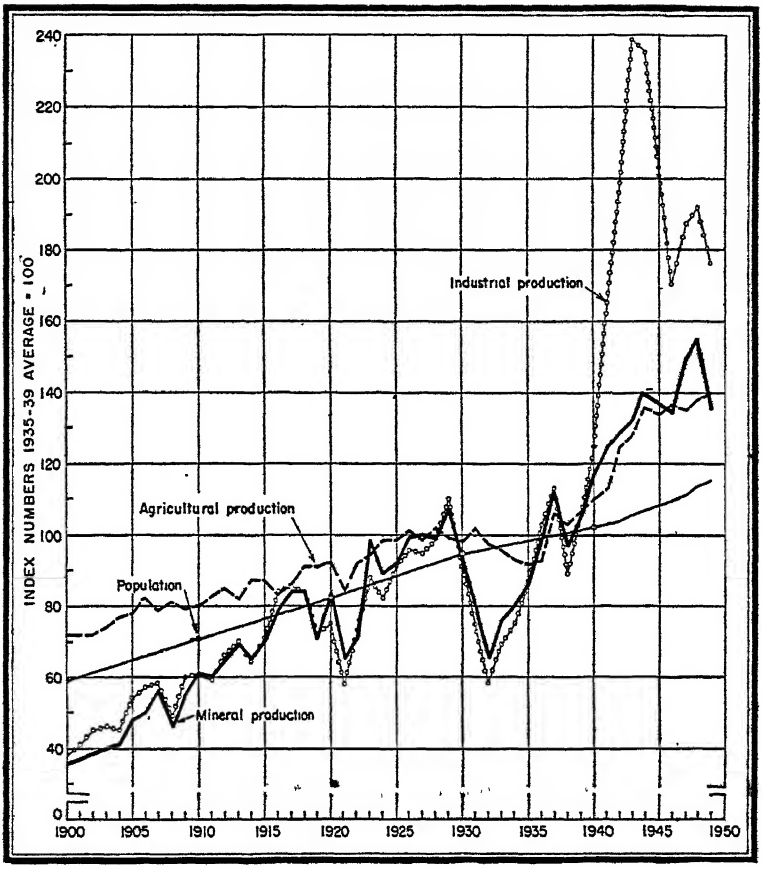

FIGURE 1.—Physical volume of mineral production compared with industrial production (manufactures and minerals), agricultural production, and population, 1900–49. Sources: Federal Reserve Board, U. S. Department of Agriculture, and Bureau of the Census.

The 15-percent decline in tonnage of mineral fuels, as a group, produced in 1949, compared with 1948, was the result of drops of 27 and 9 percent in coal and petroleum, respectively, moderated by gains of 7 and 5 percent in natural gas and natural gasoline, respectively. Nonmetallic minerals other than fuels declined more moderately (2 percent) than either other major group. Record outputs of cement, perlite, pumice, vermiculite, and asbestos were established. The sharpest nonmetallic drops (20 percent or more) involved fluorspar, feldspar, magnesium compounds, and abrasive stone. The metals group decreased 9 percent quantitatively in 1949 output. Ores of iron, molybdenum, and manganese were mined in tonnages 16, 22, and 4 percent, respectively, less than in 1948, a reflection of the 12-percent drop in steel output resulting from an economic recession and from coal and steel work stoppages. Bauxite production slumped 21 percent and copper and zinc 10 and 6 percent, respectively. Zinc output in the Tri-State district was the lowest since 1896. In contrast, lead mining increased 5 percent to the highest level since 1944. An estimate [1] of the zinc-lead ore remaining in the Tri-State district was published by the Bureau of Mines. A new book [2] on the resources of the Southern States includes numerous mineral maps of the region.

Number and Size of Firms.—The average number of mining firms operating in the United States was 33,100 (preliminary figure) in 1949, compared with 35,000 in 1948, 33,800 in 1947, and 36,000 in 1939, according to the Department of Commerce.[3] The 8-percent decrease in number of mining firms in 1939–49 was the only decline among the eight major industrial divisions, and it occurred while the number of industrial firms as a whole advanced 18 percent. Details on the number of new and discontinued businesses in mining and other industries, by size of firm and by States, in 1944–48 were published by the Office of Business Economics.[4] In the United States, 0.2 percent of the mining firms hire 37 percent of the industry's employees, and 3.5 percent of such firms hire 70 percent of the employees, as shown in table 2. This distribution represents a concentration of large companies (size measured by employment) no greater than for all industries as a whole. On the other hand, smelters, refineries, and metalworking plants are considerably more integrated than other manufacturing plants.

[1] Ruhl, Otto, Allen, Simeon A., and Holt, Stephen P., Zinc-Lead Ore Reserves of the Tri-State District, Missouri-Kansas-Oklahoma: Bureau of Mines Rept. of Investigations 4490, 1949, 59 pp.
[2] Evans, Everett F., and Donahue, Roy L., Our South: Steck Co., Austin, Tex., 1949, 406 pp.
[3] Survey of Current Business, vol. 30, No. 2, February 1950, p. 32.
[4] Foss, Murray F., and Churchill, Betty C., The Size Distribution of the Postwar Business Population: Survey of Current Business, vol. 30, No. 5, May 1950, pp. 12–20.
Churchill, Betty C., and Foss, Murray F., State Estimates of the Business Population: Survey of Current Business, vol. 29, No. 12, December 1949 pp. 8–17.

TABLE 2.—Percent distribution of firms and of employment in the mining and metal industries in the United States, March 31, 1948, by size of firm

[U. S. Department of Commerce]

Number of paid employees per firm	Number of firms: Mining	Number of firms: Manufacturing: Metals and products	Number of firms: Manufacturing: Other	Number of firms: All industries	Number of paid employees: Mining	Number of paid employees: Manufacturing: Metals and products	Number of paid employees: Manufacturing: Other	Number of paid employees: All industries
0-3	52.7	34.3	46.7	74.4	1.9	0.4	1.1	6.0
4-19	32.6	35.0	32.7	20.6	10.7	2.9	8.5	17.1
20-99	11.2	20.7	15.7	4.1	17.7	8.0	19.1	17.2
100-499	2.8	7.4	4.0	.7	23.2	14.2	23.8	15.7
500-999	.4	1.2	.5	.1	9.9	7.6	9.4	6.3
1,000 or more	.3	1.4	.4	.1	36.6	66.9	38.1	37.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

National Income.—The national income of the United States in 1949 was 217 billion dollars, of which 2 percent originated at mines and 7 percent at metal, oil, coke, stone, and ceramics-manufacturing plants, according to the Department of Commerce. In comparison, 8 percent of the national income was from farms and 0.08 percent from fisheries and forests combined. Of the 4.4-billion-dollar mine income, 42 percent was from coal mining, 36 percent from oil and gas extraction, 12 percent from metal mining, and 10 percent from nonmetallic-mineral mining.

The mining industry's income in 1949 comprised five items, as follows, in millions of dollars: Wages and salaries, 2,938; supplements to wages and salaries (employer contributions for social insurance and private pension funds, pay of military reserve, etc.), 186; income of enterprises before taxes, 1,216; inventory adjustment, 86; net interest, 15; total, 4,441.

TABLE 3.—National income originating in mining and related manufacturing industries in the United States, 1943–49, in millions of dollars

[U. S. Department of Commerce]

Industry	1943	1944	1945	1946 [1]	1947 [1]	1948 [1]	1949
Bituminous coal and lignite	1,130	1,271	1,204	1,241	1,827	2,136	1,582
Anthracite	211	238	219	286	302	349	265
Petroleum and natural gas	671	800	795	925	1,293	1,769	1,612
Metals	507	417	349	324	557	612	539
Nonmetallic minerals	238	224	222	295	371	420	443
Total mining	2,757	2,950	2,789	3,071	4,350	5,277	4,441
Iron and steel products [2]	9,099	9,081	7,376	5,588	7,647	8,720	7,789
Nonferrous metal products	1,939	1,942	1,659	1,748	1,934	2,120	1,974
Products of petroleum and coal	1,502	1,360	1,326	1,679	2,488	3,799	3,044
Stone, clay, and glass products	1,193	1,137	1,147	1,561	1,851	2,120	2,055

[1] Revised figures. [2] Including ordnance.

Equipment and Materials.—The mining industry of the United States spent $740,000,000 on new plants and equipment in 1949, compared with $800,000,000 in 1948, according to the United States Department of Commerce. These amounts constituted 4 percent of the total nonagricultural business expenditures on new plants and equipment.

Mechanization of coal mines continued to progress. Of the bituminous coal and lignite mined underground in 1949, 91.4 percent was cut by machine and 67 percent was loaded by machine—both all-time highs. Underground soft-coal mines purchased 286 mobile loaders, 8 scrapers, 394 loading conveyors, 116 "mother" haulage conveyors, and 543 shuttle cars in 1949. These shipments of mechanical loading equipment, in terms of capacity, were smaller than in any year since 1935.

Industrial explosives sold for consumption in the United States in 1949 totaled 631,230,005 pounds, 13 percent below the 1948 peak of 725,227,173 pounds but nevertheless the third highest recorded. Of the 1949 total, 91,629,597 pounds were permissible high explosives, 505,601,047 were other high explosives, 20,076,925 were black blasting powder, and 13,922,436 were liquid-oxygen explosives. Coal mining used 39 percent of these explosives, construction (railway and other) 21 percent, nonmetal mining (including quarrying) 19 percent, metal mining 18 percent, and other activities 3 percent. Estimated quantities of ingredients contained in explosives consumed in the United States in 1949 were as follows, in million pounds: Sodium nitrate 222, explosive oil (nitroglycerin, etc.) 156, ammonium nitrate 117, sulfur 13, nitrotoluenes and nitrocellulose 5, antacid 5, charcoal 3, carbonaceous combustible material 60, and wrapper paper and paraffin 37. The nitrogen content of these ingredients was 107 million pounds.[5]

Industrial consumption of electric power in the United States was estimated by the Federal Power Commission as 157 billion kilowatt-hours in 1947 compared with 134 billion in 1946. The distribution in 1946 comprised 12 billion kilowatt-hours for mining (5.6 coal, 3.5 metal, 1.6 nonmetallic mineral, and 1.0 petroleum and gas); 19 for iron and steel products; 12 for nonferrous metal products; 7 for stone, clay, and glass products; 6 for products of petroleum and coal, 22 for chemicals and allied products, and 56 billion kilowatt-hours for other manufactures. Unfortunately this statistical series was discontinued after the 1946 data were compiled.

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[5] Grumberg, Roberta W., Consumption of Industrial Explosives Decreases in 1949: Bureau of Mines Mineral Industry Surveys, Mineral Market Report 1908, 1950, 10 pp. (processed).

Productivity.—The 1949 rate of output of bituminous coal and lignite was a record-breaking 6.4 net tons per man-day, and that of anthracite was 2.9 tons, exceeded only in 1939–42. Other Bureau of Mines data indicate that 1.4 gross tons of usable iron and manganiferous ores were mined per man-hour in 1949 (preliminary figure), compared with 1.5 in 1948 and 1.4 in 1947. The decrease in 1949 was attributed partly to a 4-percent increase in the proportion of iron ore mined underground.

Over the past third of a century the domestic mining industry made substantial gains in productivity. The index of output per man-hour (1939=100), prepared by the Bureau of Labor Statistics and the Works Progress Administration, rose from 49 in 1915 to a record 111 in 1947 and then subsided slightly to 108 in 1949.[6] The upward trend was determined principally by greater mechanization and by more open-pit mining compared with underground operations. These technologic gains overcame, by a wide margin, the disadvantageous factor of decreasing grade of ores extracted.

TABLE 4.—Output per man-hour in the mining industry, 1935, 1943, and 1947–49

[Bureau of Labor Statistics indexes: 1939=100]

Year	Output per man-hour						Production	Man-hours
	Bituminous coal	Anthracite	Iron [1]	Copper [2]	Lead and zinc [2]	Total mining [3]	Total mining	
1935	82.4	79.3	87.7	97.5	99.5	84.9	88.0	103.7
1943	98.7	87.5	96.9	103.6	75.3	101.5	139.6	137.5
1947	112.1	90.5	106.0	110.8	76.5	111.1	147.7	133.0
1948	111.7	90.5	105.5	106.2	82.3	110.9	147.4	132.9
1949	109.2	90.6	101.6	105.9	85.1	108.3	119.0	109.9

[1] Based on usable ore (direct smelting ore plus beneficiated ore), not on crude ore.
[2] Based on recoverable metal, not on ore mined.
[3] Comprises the five industries shown plus the petroleum and natural gas industry. The series for the latter industry was "not considered sufficiently reliable for publication separately, although satisfactory for inclusion in the combined indexes."

[6] Searle, Allan D., and Taylor, Harriet S., Trends in Output per Man-Hour in Mining, 1935–49: Bureau of Labor Statistics, July 1950, 40 pp. (mimeographed).

TRANSPORTATION

Railroads.—Minerals comprise over half of the freight hauled by rail in the United States. The revenue freight originated by class 1 railroads in 1949 totaled 1,227 million short tons, of which 303 were bituminous coal, 37 anthracite, 19 coke, and 295 were other products of mines (including crude petroleum). The corresponding 1948 figures were 430, 48, 23, and 345 million tons, respectively, according to the Interstate Commerce Commission.

Pipelines.—Interstate and export movements of natural gas (including gas stored or lost in transmission) made a record gain of 25 percent in 1948 to 1,757 billion cubic feet, one-third of the marketed production. Petroleum refineries received by pipeline 1,434 million barrels of crude in 1949, compared with 1,475 in 1948. Pipelines for petroleum and refined products in the United States had a mileage of 152,814 in 1949, in contrast to 127,351 in 1941 and 90,170 in 1926. A report [7] showed the distribution by State and by size of these pipelines.

TABLE 5.—Shipments of various mineral products in the United States, by method of transportation in 1949, in thousands of short tons

Mineral product	Railroad	Boat	Truck	Pipeline	Not specified	Total
Cement	30,167	590	7,986			38,743
Coal:						
Bituminous and lignite	356,602	21,828	47,787			426,217
Pennsylvania anthracite	35,232		6,088			41,320
Coke (including breeze)	24,295	1,015	1,586			26,896
Fluorspar	184	53				237
Fuel briquets and packaged fuel	1,951		551			2,502
Iron and manganiferous ores	20,200	75,600				95,800
Natural gas				154,900		154,900
Petroleum [1]	[2] 5,000	49,000	(2)	217,000		271,000
Sand and gravel	70,035	19,253	219,624		10,192	319,104
Slag—iron blast furnace	9,961	402	10,922			21,285
Stone, crushed	71,640	21,419	120,454		8,895	222,408

[1] Domestic only. Data in corresponding table of Minerals Yearbook, 1948, included imported petroleum.
[2] Transportation by truck included with railroad.

[7] Coumbe, A. T., and Avery, I. F., Crude-Oil and Refined Products Pipe-Line Mileage in the United tates, Jan. 1, 1950: Bureau of Mines Inf. Circ. 7585, 1950, 8 pp. (processed).

CONSUMPTION AND SELF-SUFFICIENCY

Demand for natural gas, natural gasoline, cement, and phosphate rock—alone among the most significant minerals—was strong enough in 1949 to register record consumption. Use of bituminous coal and anthracite declined 14 and 25 percent, respectively, in 1949 compared with 1948, owing to a mid-year reduction in the level of industrial operations, competition from other fuels, abnormally warm weather, and work stoppages. Even the demand for crude petroleum dropped off 6 percent, largely because of warm weather and displacement by natural gas. The gains for natural gas and natural gasoline were 6 and 7 percent, respectively. Iron-ore consumption decreased 11 percent in response to a smaller demand for pig iron and to serious coal and steel strikes. The 1949 decline in call for the nonferrous metals, copper, aluminum, lead, and zinc was remarkably uniform, all between 13 and 17 percent. The decrease in consumption of tin was somewhat sharper; this is partly a result of 1949 being the first year in which tin-plate production by the electrolytic method (requiring less than half as much tin) exceeded that by the hot-dip method.

United States industry is fully self-sufficient in coal, sulfur, cement, phosphate, potash, molybdenum, and magnesium, and is nearly so in iron and petroleum. On the other hand, most of the aluminum, uranium, tin, mercury, and cobalt needed by the Nation in 1949 was from foreign ores, and the dependency was at least 90 percent for such vital materials as manganese, chromium, nickel, industrial diamonds, sheet mica, asbestos, radio-grade quartz, tantalum, columbium, and beryllium. An exact numerical measurement of self-sufficiency is not available because of incomplete data on stocks and because of censorship of national stockpile inventories. However, the ratio of production to actual consumption or to apparent consumption, as shown for various minerals in 1949 in table 6, is a reasonable indication of self-sufficiency. If secondary metals are taken into account, United States self-sufficiency of antimony, platinum, and tin is raised substantially, but there is slight improvement of the aluminum, zinc, and nickel position.

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TABLE 6.—Consumption and self-sufficiency of the United States in various mineral products in 1949

Mineral product [1] and unit	Production			Consumption			Self-sufficiency (percent) [3]	
	Primary	Secondary [2]	Total	Primary	Secondary	Total	Primary	Total
Aluminum, refined ... short tons	[4] 241,385	44,596	285,981	[5] 635,956	[5] 44,596	[5] 680,552	33	42
Antimony ... do	2,719	14,976	17,695	11,530	[5] 14,976	26,506	24	67
Asbestos ... do	42,918		42,918	[5] 541,069		[5] 541,069	8	8
Bauxite ... thousand long tons (dried equivalent)	1,149		1,149	2,667		2,667	43	43
Beryllium concentrates ... short tons	346		346	[5] 4,157		[5] 4,157	8	8
Cement ... thousand barrels (376 pounds)	212,913		212,913	[5] 204,862		[5] 204,862	104	104
Chromite ... short tons	433		433	672,773		672,773	(6)	(6)
Coal:								
Anthracite ... thousand short tons	42,702		42,702	[5] 37,700		[5] 37,700	113	113
Bituminous and lignite ... do	437,868		437,868	445,538		445,538	98	98
Cobalt ... short tons	261		261	2,351		2,351	11	11
Columbium concentrates ... do				[5] 779		[5] 779	0	0
Copper ... thousand short tons	753	384	1,137	1,072	[5] 384	1,456	70	78
Diamonds, industrial ... thousand carats				[5] 6,364		[5] 6,364	0	0
Fluorspar ... short tons	236,704		236,704	345,221		345,221	69	69
Graphite (natural) ... do	6,102		6,102	16,302		16,302	37	37
Iron ore (usable) ... thousand long tons	84,937		84,937	89,218		89,218	95	95
Iron, pig and scrap ... thousand short tons	51,063	24,031	75,094	53,447	[5] 25,172	78,619	96	96
Kyanite ... short tons	12,115		12,115	[5] 24,234		[5] 24,234	50	50
Lead ... do	409,908	364,140	774,048	593,534	[5] 364,140	957,674	69	81
Magnesium, refined metallic ... do	11,598	2,939	14,537	11,947	[5] 2,939	14,886	97	98
Manganese ore ... thousand short tons	126		126	1,360		1,360	9	9
Mercury ... flasks (76 pounds)	9,930		9,930	39,857		39,857	25	25
Mica, sheet and punch ... short tons	257		257	[5] 5,500		[5] 5,500	5	5
Molybdenum concentrates ... do	11,265		11,265	9,980		9,980	113	113
Nickel ... do	790	1,914	2,704	67,424	[5] 1,914	69,338	1	4
Petroleum, crude ... million barrels	1,840		1,840	1,965		1,965	94	94
Phosphate rock ... thousand long tons	8,877		8,877	[5] 7,735		[5] 7,735	115	115
Platinum group ... troy ounces	24,807	83,447	108,254	205,176	[5] 83,447	288,623	12	38
Potash ... thousand short tons	2,057		2,057	[5] 1,980		[5] 1,980	104	104
Quartz, radio-grade ... pounds				46,200		46,200	0	0
Sulfur (native) ... thousand long tons	4,745		4,745	[5] 3,410		[5] 3,410	139	139
Tantalum concentrates ... short tons				[5] 68		[5] 68	0	0
Tin ... long tons	68	14,753	14,821	47,163	25,243	72,406	(6)	20
Tungsten ... short tons	1,448		1,448	2,479		2,479	58	58
Zinc ... do	593,203	51,651	644,854	797,589	[5] 51,651	849,240	74	76

[1] Production of metals, unless otherwise specified, is recoverable metal content of ore mined; production of metals described as refined is refinery production from domestic ores. Consumption of metals, unless otherwise specified, is of refined metal from domestic and foreign ores.
[2] From old scrap only.
[3] Ratio of production to consumption.
[4] Estimate for metal from domestic ores only.
[5] Apparent consumption.
[6] Less than 0.5 percent.

STOCKS

Bituminous-coal stocks held by consumers and retail coalyards decreased 35 percent during 1949, reaching a level approximating that in 1944-47. Anthracite stocks in the hands of producers were virtually unchanged.

Industry inventories of pig iron and of primary lead in all forms and producers' stocks of aluminum metal increased 3, 27, and 121 percent, respectively, to postwar highs. Although industry holdings of slab zinc gained 50 percent during 1949, the year-end mark was 35 percent below that of December 1946. One metal whose stocks declined was refined copper (producers and fabricators) 7 percent.

Cement mills during 1949 added 33 percent to the number of barrels on hand, resulting in a year-end inventory greater than at any comparable time since 1945. Producers' stocks of sulfur, phosphate rock, and potash declined 4, 23, and 25 percent, respectively. In 1943-49, sulfur stocks fell 39 percent, as production was unable to keep up with demand; this is partly a result of depletion of unmined reserves.

PRICES

The postwar surge in mineral prices as a whole leveled off during 1949, when the rise was less than 1 percent, according to the Bureau of Mines index of producers' sales of 24 minerals,[8] representing all but a few percent of the total value of United States mineral production. Among the three major mineral groups, fuels in 1949 continued to be the most costly (compared with 1940) despite a 2-percent price decline during the year. This group decline was counteracted by price increases of 3 percent for other nonmetallic minerals and of 7 percent for metals. The most notable individual price increases were for molybdenum concentrates (20 percent) and pig iron (14 percent); the molybdenum price change was the first since 1938. The sharpest price decreases in 1949 were for natural gasoline (23 percent) and lead (12 percent), although the natural-gasoline price remained above the 1947 level.

TABLE 7.—Weighted average price index of 24 major mineral commodities, 1943–48

[1940=100]

Group	1943	1944	1945	1946	1947	1948	1949 [1]
Minerals (all groups)	119.7	122.7	125.3	138.7	168.5	203.5	205.1
Mineral fuels	122.6	126.9	129.5	145.3	181.7	227.2	222.6
Nonmetals (other than fuels)	112.0	113.7	115.4	122.2	134.6	146.0	150.4
Metals [2]	117.1	118.0	120.9	132.4	156.6	189.5	193.0

[1] Preliminary.
[2] Includes bonus payments on copper, lead, and zinc, 1943-47.

[8] Fuels—bituminous coal and lignite, natural gas, natural gasoline and cycle products, and crude petroleum. Nonmetals—cement, clay, lime, phosphate rock, natural pigments, potash, salt, sand and gravel, stone, and native sulfur. Metals (refined)—aluminum, copper, ferro-alloys, gold, pig iron, lead, magnesium, molybdenum concentrates, silver, and zinc.

Wholesale prices of commodities as a whole declined 6 percent, as reflected in the Bureau of Labor Statistics index (1926=100) of 155.0 in 1949 and 165.1 in 1948. This index includes the mineral-products components shown in table 8.

TABLE 8.—Wholesale price indexes of mineral-product groups, 1947–49

[Bureau of Labor Statistics, 1926=100]

Product	1947	1948	1949	Product	1947	1948	1949
FUELS				NONMETALLICS			
Anthracite	117.6	[1] 130.9	137.0	Brick and tile	140.0	156.3	161.7
Bituminous coal	157.6	187.0	192.0	Cement	115.7	[1] 130.4	133.8
Coke	166.6	207.1	222.2	Chemicals	118.7	[1] 126.7	117.4
Petroleum products	90.2	122.1	112.2	Fertilizer materials	105.6	116.1	119.7
				Paint and materials	162.6	[1] 159.6	151.1
METALS							
Iron and steel	133.7	[1] 155.1	165.7				
Nonferrous metals	140.3	157.5	144.3				
Structural steel	134.5	163.7	179.3				

[1] Revised figure.

EMPLOYMENT, WAGES, AND SAFETY

Employees in the mining industry in 1949 averaged 917,000, 7 percent less than in the preceding year but 5 percent more than in 1946, according to the Bureau of Labor Statistics. Earnings per full-time employee in the mining industry in 1949 averaged $3,204, a 5-percent cut from 1948 but a 3-percent gain over 1947.

TABLE 9.—Number of employees and average earnings in mining and related manufacturing industries, 1947–49

[U. S. Bureau of Labor Statistics]

Industry	Number of full-time equivalent employees (thousands)			Average annual earnings per full-time employee		
	1947 [1]	1948 [1]	1949	1947 [1]	1948 [1]	1949
Bituminous coal and lignite	429	452	399	$3,212	$3,383	$2,922
Anthracite	80	81	77	3,125	3,420	2,896
Petroleum and natural gas	235	255	250	3,157	3,584	3,736
Metals	99	101	95	3,000	3,327	3,411
Nonmetallic minerals	95	97	96	2,663	2,928	3,031
Total mining	938	986	917	3,113	3,387	3,204
Iron and steel products [2]	1,863	1,872	1,661	3,063	3,360	3,390
Nonferrous metal products	482	476	425	2,969	3,248	3,268
Products of petroleum and coal	228	235	229	3,610	4,072	4,179
Stone, clay, and glass products	503	523	487	2,672	2,925	3,012

[1] Revised figures. [2] Including ordnance.

The average number of days worked by the mining and metallurgical industries (exclusive of petroleum and steelmaking) was 207 (preliminary figure) in 1949, compared with 249 in 1948 and 256 in 1947, according to the Bureau of Mines. Idleness from work stoppages in the mineral industries, particularly the coal industry, in

1949 constituted nearly 40 percent of the total man-days lost by stoppages in all industries, the United States Department of Labor reported. Fewer employees working fewer days resulted in a 20-percent decline in man-hours worked in the mineral industries in 1949 compared with 1948.

Mines in the United States were less hazardous in 1949 than ever before. The nonfatal injury frequency rate in mining and metallurgical industries improved from 48.7 per million man-hours in 1948 to 45.5 in 1949. The number of fatalities, partly due to shorter exposure, declined from 1,227 in 1948 to 772 in 1949. A report [9] was published on the causes of mine accidents and on progress through the years in preventing such accidents.

FOREIGN TRADE [10]

Imports of mineral products were valued at 2.5 billion dollars in 1949, compared with 3.6 in 1948 and 3.2 in 1947. Exports of mineral products were valued at 2.3 billion dollars in 1949, 2.8 in 1948, and 3.0 in 1947. The leading mineral imports in 1949 were gold, petroleum, copper, tin, and lead. The principal mineral exports in 1949 were iron (including manufactures), petroleum and products, coal, copper, and gold.

In terms of tonnage, four-fifths of all the imports and exports of the United States in 1949 were minerals. This proportion is derived from table 12 by comparing the mineral entries with the total minus "undistributed." Petroleum and its products constituted, on a weight basis, 52 percent of total imports and 17 percent of total exports. Coal represented 34 percent of all exports.

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[9] Harrington, D., East, J. H., Jr., and Warncke, R. G., Safety in the Mining Industry: Bureau of Mines Inf. Circ. 7485, 1949, 157 pp.

[10] Figures on imports and exports compiled by M. B. Price and V. N. L. Glendening, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 10.—Imports for consumption of mineral products by the United States, 1947–49

[U. S. Department of Commerce]

Mineral product and unit	Quantity			Value (thousand dollars)		
	1947	1948	1949	1947	1948	1949
METALS						
Aluminum:						
Bauxite short tons (dried equivalent)	2,063,237	2,865,001	3,058,129	11,870	15,821	16,353
Metal short tons	31,329	160,881	125,326	6,300	41,799	36,093
Compounds do	80	5,566	1,648	2	128	66
Manufactures	----------	----------	----------	304	404	723
Antimony:						
Ore short tons (Sb content)	9,257	13,464	7,473	2,672	4,312	2,488
Metal short tons	5,896	3,734	1,934	3,495	2,337	1,285
Beryllium ore do	767	1,720	3,811	115	299	858
Bismuth metal do	155	150	271	481	465	834
Boron alloys do	1	3	(1)	1	2	(2)
Cadmium:						
Flue dust short tons (Cd content)	1,178	914	895	1,673	1,438	1,596
Metal short tons	10	5	79	32	22	303
Calcium metal do	(1)	(1)	2	(2)	2	5
Chromium:						
Chromite short tons (Cr_2O_3 content)	485,991	680,723	533,591	18,867	33,010	24,189
Ferrochromium short tons (Cr content)	6,450	4,714	4,012	1,725	1,471	1,280
Cobalt:						
Ore, metal, and alloy [3] short tons	3,975	3,917	3,611	8,903	10,267	10,944
Compounds do	376	396	180	756	833	386
Columbium ore do	1,411	987	779	858	659	562
Copper: [4]						
Ore and concentrates short tons (Cu content)	80,977	63,302	127,525	31,936	24,927	48,405
Metal do	371,846	426,266	441,495	143,433	177,670	170,707
Alloys short tons	79,315	40,855	15,138	41,580	19,764	5,542
Manufactures	----------	----------	----------	1,106	1,458	6,521
Gold:						
Ore and base bullion troy ounces (Au content)	1,002,000	1,006,000	1,034,967	34,945	35,136	36,160
Bullion do	54,414,000	54,255,000	21,005,995	1,904,557	1,898,916	735,210
Alloy (coin)	----------	----------	----------	140,086	47,123	20
Iron:						
Ore short tons	5,483,130	6,841,804	8,290,416	22,073	27,330	36,791
Metal (pig and scrap) do	103,305	703,057	1,240,168	2,863	24,158	34,295
Semimanufactures do	11,252	70,526	161,729	1,625	6,976	14,234
Manufactures do	22,819	85,283	142,850	4,491	10,550	16,953
Lead:						
Ore [4] short tons (Pb content)	47,152	33,976	122,224	8,884	8,353	34,526
Metal do	176,493	284,692	287,578	41,540	92,583	84,427
Alloy do	2,687	14,989	6,148	972	5,493	2,720
Other do	472	1,629	334	171	670	173
Magnesium metal short tons	202	678	2,560	99	185	537
Manganese:						
Ore short tons (Mn content)	627,895	703,235	673,647	21,360	23,339	26,796
Ferro-alloys do	65,181	78,426	53,907	10,847	14,517	11,393
Mercury metal flasks (76 pounds)	13,008	31,951	103,141	829	1,567	6,762
Nickel:						
Ore and matte short tons	14,636	13,854	11,128	3,751	3,576	4,598
Metal do	58,687	71,567	73,774	35,370	47,454	54,833
Compounds do	15,074	21,514	12,242	6,458	10,001	6,585
Manufactures [5] do	19	4	----------	17	9	5
Platinum group:						
Ore and concentrates troy ounces (Pt metals content)	1,176	1,893	505	91	163	18
Metal do	307,689	270,840	217,779	11,701	14,811	11,882
Radium:						
Salts grams (Ra content)	76,681	77,018	98,032	1,505	1,385	1,720
Substitutes	----------	----------	----------	----------	6	(2)
Rare-earth metals short tons	(1)	1	2	4	12	2
Selenium do	265	134	86	893	490	317
Silver:						
Ore and base bullion troy ounces (Ag content)	30,266,000	35,339,000	31,997,848	21,616	25,698	22,566
Bullion do	53,546,000	49,636,000	63,793,953	39,243	36,911	45,656
Alloy (coin)	----------	----------	----------	7,281	8,275	5,313
Silicon metal and alloys short tons	13,859	7,614	7,652	465	258	323
Tantalum ore do	209	64	68	387	83	237

See footnotes at end of table.

TABLE 10.—Imports for consumption of mineral products by the United States, 1947–49—Continued

[U. S. Department of Commerce]

Mineral product and unit	Quantity			Value (thousand dollars)		
	1947	1948	1949	1947	1948	1949
METALS—continued						
Tin:						
Concentrates short tons (Sn content)	32,939	41,991	42,908	43,221	72,170	78,176
Metal do	27,887	55,100	67,451	42,685	103,323	133,696
Compounds do	15	5	(1)	17	13	1
Manufactures[6] do	117	840	576	29	678	446
Titanium:						
Ilmenite short tons	301,311	242,119	324,157	1,791	1,759	2,479
Rutile do	7,576	8,771	3,085	469	589	180
Ferrotitanium do	45	28	37	28	17	20
Tungsten:						
Ore and concentrates short tons (W content)	[7] 3,463	4,237	3,344	[7] 7,245	8,716	6,341
Metal do	5	(1)	7	18	(2)	22
Ferrotungsten do	----------	----------	23	----------	----------	31
Vanadium ore and concentrates short tons (V content)	528	526	276	464	534	272
Zinc:						
Ore[4] short tons (Zn content)	292,149	174,452	155,598	12,165	14,702	16,008
Metal do	78,168	102,929	129,345	15,262	26,131	29,912
Compounds do	413	207	388	48	18	61
Manufactures	----------	----------	----------	4	16	3
Zirconium ore short tons	30,696	18,154	20,833	891	571	637
Other metallic mineral substances, crude or semimanufactures short tons	7,458	17,617	13,932	1,132	901	378
Total metal products	----------	----------	----------	2,725,702	2,913,254	1,792,855
FUELS						
Anthracite short tons	10,350	945	----------	50	7	----------
Bituminous coal do	290,141	291,337	314,980	1,563	2,003	2,368
Coal-tar products	----------	----------	----------	11,514	18,169	13,181
Coke short tons	104,093	161,400	277,507	763	2,110	3,976
Fuel briquets do	387	329	365	3	3	3
Petroleum, crude thousand barrels (42 gallons)	99,284	128,431	154,826	161,535	282,965	341,169
Petroleum products:						
Fuel, residual, and lubricating oils thousand barrels (42 gallons)	63,083	59,412	84,176	86,073	127,396	133,778
Motor fuel and kerosine do	381	579	19	1,061	2,396	123
Other[8]	----------	----------	----------	1,732	3,009	3,278
Total mineral fuels	----------	----------	----------	264,294	438,058	497,876
NONMETALLIC MINERALS						
Abrasives:						
Diamonds, industrial carats	4,117,189	10,648,258	6,364,049	13,639	33,269	17,669
Other natural[9] short tons	25,952	25,607	21,251	888	978	644
Artificial do	168,951	174,672	129,548	10,272	10,918	8,023
Arsenic:						
Metal do	9	15	28	10	18	19
Oxide (white arsenic) do	13,940	9,336	4,696	1,145	884	565
Compounds, other do	124	63	50	45	24	15
Asbestos do	594,839	647,881	515,303	29,822	37,974	33,940
Asphalt and related bitumens, natural short tons	6,265	4,933	4,182	254	169	90
Barium:						
Barite do	53,222	53,204	26,389	378	444	195
Witherite do	739	2,470	2,113	26	96	63
Compounds do	72	152	96	11	21	14
Boron:						
Minerals pounds	1,884	3,056	556	1	2	(2)
Carbide short tons	9	15	15	23	31	36
Bromine do	(1)	(1)	(1)	45	39	20
Calcium chloride do	250	5	(1)	6	(2)	(2)
Carbon black do	3,820	5,110	3,926	834	1,294	984
Celestite do	14,117	21,771	9,384	243	559	177
Cement do	899	53,188	20,652	41	797	336

See footnotes at end of table.

TABLE 11.—Exports of mineral products from the United States, 1947–49—Con.

[U. S. Department of Commerce]

Mineral product and unit	Quantity			Value (thousand dollars)		
	1947	1948	1949	1947	1948	1949
METALS—continued						
Silver:						
Ore and base bullion troy ounces (Ag content)		4,000			2	
Bullion do	28,293,000	1,281,000	3,006,741	21,206	951	2,180
Alloy (coin)				9,442	11,447	21,101
Tantalum concentrates, metal, and alloys short tons	1	[1]	3	31	34	95
Tin:						
Metal do	465	87	85	650	163	177
Manufactures				829	1,684	2,245
Titanium:						
Concentrates short tons	1,266	1,454	1,505	193	187	143
Ferrotitanium do	509	480	179	81	83	41
Compounds do	21,171	26,824	29,621	5,184	7,127	8,141
Tungsten:						
Ore and concentrates do	155	415	102	90	401	85
Ferrotungsten do	41	628	310	135	1,838	861
Metal do	122	91	53	1,974	1,363	1,188
Vanadium:						
Ore and concentrates short tons (V content)	4	7	12	16	32	26
Ferrovanadium short tons	89	119	97	266	390	351
Metal and nonferrous alloys do	[1]	1	1	[2]	11	18
Zinc:						
Ore and concentrates do	1,404	3,547	2,925	215	422	478
Metal do	119,213	73,772	68,425	27,500	19,443	22,682
Compounds do	32,734	29,657	19,500	6,554	5,229	3,426
Zirconium:						
Ore do	330	312	305	26	24	24
Metal and alloys do	5	11	37	6	8	13
Other ores and concentrates do	2,419	9,859	2,541	3,535	2,908	1,195
Other ferro-alloys do	36,098	55,647	7,921	1,196	1,840	766
Other metals and alloys do	2,320	2,795	921	1,462	1,465	651
Total metal products				1,435,986	1,292,423	1,126,257
FUELS						
Anthracite short tons	8,509,995	6,675,914	4,942,670	90,220	86,203	64,785
Bituminous coal [6] do	[7] 6,866,963	45,930,133	27,842,056	[7] 528,700	392,826	232,393
Coal-tar products				120,804	101,018	83,384
Coke short tons	835,059	706,782	548,256	10,738	10,591	8,323
Fuel briquets do	248,760	207,885	167,140	2,791	2,654	2,438
Natural gas million cubic feet	8,035	5,645	5,170	1,143	1,115	1,162
Natural-gas liquids:						
Natural gasoline thousand barrels (42 gallons)	4,832	4,066	4,363	17,111	20,126	17,465
LP-gases thousand gallons	53,233	45,520	53,383	4,573	5,259	5,777
Petroleum, crude thousand barrels (42 gallons)	46,356	39,737	33,068	99,074	116,763	98,425
Petroleum products:						
Fuel, residual, and lubricating oils thousand barrels (42 gallons)	48,961	41,771	30,949	275,476	289,589	216,607
Motor fuel and kerosine do	44,614	31,674	31,439	160,766	152,753	160,169
Other [5]				67,245	59,784	50,624
Total mineral fuels				1,378,641	1,238,681	941,552
NONMETALLIC MINERALS						
Abrasives, natural and artificial				20,954	15,268	17,447
Arsenate, calcium and lead short tons	4,036	3,303	2,454	1,059	864	510
Asbestos:						
Unmanufactured do	2,087	6,530	17,621	316	1,173	3,619
Manufactures				12,823	10,471	10,898
Asphalt and related bitumens, natural short tons	23,902	13,682	16,672	1,065	559	823
Boron minerals do	85,736	70,940	109,491	4,652	4,075	6,863
Bromine do	896	527	463	587	433	403
Calcium chloride do	11,955	11,456	21,094	503	438	508
Carbon black do	159,538	160,957	151,622	26,849	28,524	26,800
Cement barrels (376 pounds)	[8] 6,771,250	5,922,163	4,561,899	[8] 21,827	20,917	15,961

See footnotes at end of table.

TABLE 11.—Exports of mineral products from the United States, 1947–49—Con.

[U. S. Department of Commerce]

Mineral product and unit	Quantity			Value (thousand dollars)		
	1947	1948	1949	1947	1948	1949
NONMETALLIC MINERALS—continued						
Clays:						
Raw ... short tons	267,123	266,849	244,883	4,603	5,138	4,796
Manufactures				19,991	20,744	22,923
Cryolite ... short tons	926	713	363	216	139	78
Fluorspar ... do	1,180	644	783	44	25	33
Graphite ... do	1,546	1,047	1,352	172	128	159
Gypsum:						
Crude, crushed, or calcined ... do	33,208	10,797	17,567	622	260	423
Manufactures				978	1,057	1,513
Kyanite ... short tons	239	462	1,039	21	22	47
Lime ... do	50,784	63,088	59,927	714	865	937
Mica ... do	1,493	1,403	1,108	970	720	677
Mineral-earth pigments ... do	7,613	6,929	6,443	1,187	1,002	827
Mineral wax (ozokerite, etc.) ... do	14,806	6,110	1,011	5,339	2,099	584
Nitrogen compounds ... do	274,875	863,692	1,179,333	16,094	52,588	62,992
Phosphate:						
Phosphate rock ... do	[10] 843,715	1,278,328	1,408,917	[10] 7,005	10,485	11,832
Phosphatic fertilizers ... do	[11] 261,760	429,902	360,711	[11] 5,632	6,515	6,551
Potash ... do	124,909	128,068	126,754	8,686	8,289	7,110
Salt ... do	[12] 188,307	387,601	359,776	[12] 1,589	5,930	3,353
Slate				605	587	595
Sodium carbonate ... short tons	107,000	207,000	77,000	8,704	9,654	2,818
Stone	([13])	([13])	([13])	1,133	1,015	960
Sulfur:						
Crude ... short tons	1,454,947	1,414,463	1,602,626	25,388	26,779	30,490
Refined ... do	56,534	36,545	33,657	2,319	1,774	1,683
Talc:						
Unmanufactured ... do	[14] 17,557	16,327	15,840	[14] 430	432	440
Manufactures				4,252	2,229	1,634
Other nonmetallic minerals				7,282	7,223	7,696
Total nonmetallic minerals				214,611	248,421	254,983
Total mineral products				3,029,238	2,779,525	2,322,792

[1] Less than 1 ton.
[2] Less than $1,000.
[3] Quantity excludes and value includes certain copper manufactures for which weight is not recorded, as follows: 1947—$2,580,974; 1948—$2,249,857; 1949—$1,655,349.
[4] Quantity excludes and value includes hardware and certain other brass and bronze manufactures for which weight is not recorded, as follows: 1947—$8,655,453; 1948—$6,337,009; 1949—$5,499,295.
[5] Quantity excludes and value includes advanced manufactures for which weight is not recorded, as follows: 1947—$87,570,810; 1948—$57,376,497; 1949—$52,410,757.
[6] Amounts stated do not include fuel or bunker coal loaded on vessels engaged in foreign trade, which aggregated 1,689,328 short tons in 1947, 1,057,118 tons in 1948, 874,029 tons in 1949; corresponding values not available.
[7] Exclusive of 102,179 tons valued at $1,010,820 exported to Austria as a part of the Army Civilian Supply Program.
[8] Wax, manufactured asphalt, petroleum coke, petroleum jelly, etc.
[9] Excludes 198,723 barrels valued at $839,916 exported to Korea under the Army Civilian Supply Program.
[10] Excludes 996,430 short tons valued at $10,648,643 exported under the Army Civilian Supply Program.
[11] Excludes 22,075 short tons valued at $1,324,521 exported to Japan under the Army Civilian Supply Program.
[12] Excludes 96,479 short tons valued at $2,347,679 exported under the Army Civilian Supply Program.
[13] Quantity not recorded in tons.
[14] Excludes 599 short tons valued at $30,589 sent to Japan under the Army Civilian Supply Program.

TABLE 12.—Imports and exports of the United States, by commodities, 1948–49, in millions of long tons (shipping weight)

[U. S. Departments of Commerce and of the Army]

Commodity	Imports[1]				Exports[1]			
	1948	1949			1948	1949		
	Total	Seaboard	Great Lakes	Total	Total	Seaboard	Great Lakes	Total
Fuels:								
Anthracite	--------	--------	--------	--------	1.5	1.2	--------	1.2
Bituminous coal	--------	--------	--------	--------	34.3	10.3	10.4	20.7
Coke	--------	--------	--------	--------	--------	--------	.1	.1
Petroleum and products	29.0	35.8	--------	35.8	13.0	9.8	1.1	10.9
Metals:								
Bauxite	2.8	2.9	--------	2.9	--------	--------	--------	--------
Chromite	1.4	1.1	--------	1.1	--------	--------	--------	--------
Iron ore	5.9	5.4	1.7	7.1	2.9	--------	2.1	2.1
Manganese ore	1.3	1.5	--------	1.5	--------	--------	--------	--------
Steel-mill products	--------	--------	--------	--------	3.2	3.4	--------	3.4
Nonmetallic minerals:								
Nitrogenous fertilizer materials	.7	.7	--------	.7	--------	--------	--------	--------
Phosphatic fertilizer materials	--------	--------	--------	--------	.6	1.0	--------	1.0
Sand and gravel	.3	--------	.3	.3	--------	--------	--------	--------
Sulfur	--------	--------	--------	--------	1.2	1.3	--------	1.3
Nonmetallic minerals, n. e. s.	2.9	2.6	--------	2.6	.8	--------	.8	.8
Rubber	.8	.7	--------	.7	--------	--------	--------	--------
Wood and paper[1]	2.4	1.1	1.0	2.1	1.0	.9	--------	.9
Cotton (unmanufactured)	--------	--------	--------	--------	.7	1.3	--------	1.3
Food and feed products[1]	7.8	7.5	.9	8.4	8.6	7.7	.6	8.3
Undistributed[1]	4.9	5.5	.4	5.9	11.1	11.6	.6	12.2
Total	60.2	64.8	4.3	69.1	78.9	48.5	15.7	64.2

[1] If a commodity is only a minor factor in either seaboard or Great Lakes trade, the tonnage for that area is excluded from the commodity total and included with "undistributed." The totals shown for the commodity groups "wood and paper" and "food and feed products" represent only the sum of major items; minor items are included with "undistributed."

INCOME AND TAXATION

Mining enterprises in the United States earned 1,216 million dollars in 1949, compared with 1,814 in 1948, 1,355 in 1947, and 681 in 1946 (revised figures).[11] These earnings are after wages, salaries, inventory adjustment, and interest but before depletion charges and taxes. Federal and State taxes on total corporate income in the mining industry ranged between 27 and 34 percent in 1942–48 but dropped to 23 percent in 1949. Of the five major mining groups, the nonmetallics industry paid the highest tax rate (32 percent) in 1949 and oil and gas producers the smallest (19 percent). The average rate on all corporations in the United States was 38 percent.

TABLE 13.—Income and corporation taxes of mining and related manufacturing enterprises in the United States in 1949, in millions of dollars [1]

[U. S. Department of Commerce]

Industry	Corporate income				Income of unincorporated enterprises	Grand total
	Taxes (Federal and State)	Dividend payments	Undistributed	Total		
Bituminous coal and lignite	66	53	128	247	46	293
Anthracite	4	8	7	19	4	23
Petroleum and natural gas	87	125	236	448	139	587
Metals	40	82	53	175	7	182
Nonmetallic minerals	38	37	44	119	12	131
Total mining	235	305	468	1,008	208	1,216
Iron and steel products [2]	761	434	683	1,878	50	1,928
Nonferrous metal products	117	115	77	309	23	332
Products of petroleum and coal	396	538	793	1,727	3	1,730
Stone, clay, and glass products	182	122	179	483	40	523

[1] Before deduction of depletion charges.
[2] Including ordnance.

[11] Office of Business Economics, National Income and Product of the United States: Survey of Current Business, vol. 30, No. 7, July 1950, pp. 5–35.

MINERAL POLICY DEVELOPMENTS

Economic Cooperation with Europe.—Commodity procurements authorized by the Economic Cooperation Administration by the end of 1949 for shipment to western Europe totaled 7.4 billion dollars. Of this amount, 32 percent was for food and feed, 27 percent for mineral products, 25 percent for textiles, forest products, tobacco, and chemicals, and 16 percent for machinery and vehicles. The 1,985 million dollars authorized for mineral products comprised 775 for petroleum and products, 572 for nonferrous metals, 281 for coal, 245 for iron and steel, and 112 for nonmetallic minerals including fertilizer. These shipments helped the participating Europeans to boost their industrial production in the final quarter of 1949 to a high 20 percent above the prewar level. Besides raw materials, the war-devastated European economy needed replacement, modernization, and expansion of its productive facilities. Of the industrial projects planned at the end of 1949, those with an aggregate cost of 1.4 billion dollars were approved by the Economic Cooperation Administration and will be financed by that agency to the extent of about one-fourth the cost. More than three-fourths of the approved industrial projects are for mining or refining minerals. The amount actually authorized by ECA for industrial projects as of December 31, 1949, was 188 million dollars, of which 93 were for iron and steel production, 12 for petroleum refining, 8 for coal mining, 7 for iron mining, and 2 each for potash mining, aluminum refining, and cement production.

Each participating country places in a counterpart fund local currency equal to the ECA dollar grants. Five percent of the counterpart funds is reserved for the United States to use for informational activities, ECA administrative expenses, and purchase of strategic materials. In this manner the United States acquired by the end of 1949 industrial diamonds, bauxite, graphite, and cryolite worth 13 million dollars. Such purchases were limited by the relatively small surplus of strategic materials in participating countries. ECA committed in 1948 and 1949 the equivalent of 6 million dollars in counterpart funds for development of strategic materials under contracts providing for repayment in materials for the United States National Stockpile. The principal project involved was modernization and expansion of lead-zinc mining at Bou Beker, French Morocco. Other projects included exploring for minerals in British African territories and developing mining of lead-zinc in Sweden, cobalt in Northern Rhodesia, and kyanite in Kenya.

American Investments Abroad.—United States residents had investments abroad at the close of 1948 (in firms in which they held at least 25 percent of the stock) totaling 11.4 billion dollars. Of this amount, 27 percent was in the petroleum industry and 10 percent represented other mining and smelting enterprises, according to the Department of Commerce. Capital movements abroad (exclusive of reinvested earnings) in 1946–48 were 1,650 million dollars, three-fourths of which was for the petroleum industry, notably in Saudi Arabia and Venezuela. These investments were stimulated primarily by the increasing world demand for oil and by the availability of large proven reserves of oil abroad. Furthermore, Venezuela instituted a requirement that 10 percent of its crude petroleum output be refined within the country; this led to the construction of American-owned refineries there.[12]

TABLE 14.—Value of private United States direct investments[1] abroad, by industry division and area, on Dec. 31, 1948, in millions of dollars

[U. S. Department of Commerce]

Industry division	Canada	Latin American Republics	OEEC countries		Other Europe	Other countries	Total
			Home	Dependencies			
Petroleum	278	1,376	369	391	68	565	3,047
Other mining and smelting	501	433	65	42	82	24	1,147
Manufacturing	1,573	676	1,035	17	113	189	3,603
Other industries	835	1,726	552	90	80	299	3,582
Total	3,187	4,211	2,021	540	343	1,077	11,379

[1] Direct investments comprise foreign branches of American companies, and foreign corporations in which United States residents hold 25 percent or more of the voting stock.

Stockpiling.—The objective of the National Stockpile is to have on hand a supply of materials sufficient to bridge the gap between wartime requirements and available wartime supply. As envisaged at the end of 1949, such stocks would cost $3,773 million. Of this amount, $1,149 million represented materials on hand, $416 million was obligated for materials on order, and $1,208 million (a third of which was appropriated) was unexpended. The Munitions Board stated that some materials could not be stockpiled fast enough, because world production was too low to meet current industrial needs and still leave a margin to be reserved for future emergency.

[12] Abelson, Milton, Private United States Direct Investments Abroad: Survey of Current Business, vol. 29, No. 11, November 1949, pp. 18–23.

The Munitions Board 1948 list of strategic minerals subjected to stockpiling was presented in Minerals Yearbook, 1948, pages 12–13. The 1949 version of the list added to group I (materials acquired by purchase or by transfer from Government agencies) aluminum metal, chemical-grade chromite, and crocidolite asbestos. At the same time the following minerals, all formerly in group II (strategic but not recommended for stockpile purchase), were dropped from the strategic list: Barite, English chalk, emery, optical glass, iron ore, petroleum and products, radium, and scrap iron and steel. The materials remaining in group II were to be stockpiled but only through transfer of Government-owned surpluses.

Several papers[13] on stockpile policies were published.

Mining Law.—The Commission on Organization of the Executive Branch of the Government presented evidence of needed revisions in mining law and listed recommendations.[14]

TECHNOLOGY

Geophysical exploration was employed to locate a lead-zinc deposit at Silver City, N. Mex.,[15] and to search for asbestos in Maine.[16] Further progress was made in jet-piercing drilling of traprock.[17] Bureau of Mines engineers in 1945–48 surveyed water pools in Pennsylvania anthracite mines.[18] In the interest of mine safety, reports were made on practices in dredging and hydraulic operations,[19] accidents in Lake Superior iron mines,[20] characteristics of explosives,[21] and permissible mine equipment.[22] Intensive work continues on iron-ore beneficiation[23] and on hydrogenation of coal to yield liquid fuels.[24] The Bureau of Mines cooperated with the American Gas Association in investigating prevention of "freezing" of natural-gas transmission lines.[25]

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[13] Lund, Richard J., Stock Piling—Past, Present, and Future: Min. Eng., vol. 1, No. 8, August 1949, sec. 1, pp. 33–36.
Ramsey, R. H., The Snarl in Stockpiling Means Trouble for You: Eng. and Min. Jour., vol. 150, No. 9, September 1949, pp. 72–75.

[14] Engineering and Mining Journal, Hoover Commission Recommends Modernizing Mining Laws: Vol. 150, No. 5, May 1949, pp. 68–71.

[15] Romberg, Frederick, Gravity Meter Survey Leads to Ore Discovery: Eng. and Min. Jour., vol. 150, No. 3, March 1949, pp. 52–55.

[16] Hurley, Patrick M., Airborne Magnetic Survey in Maine: Eng. and Min. Jour., vol. 150, No. 8, August 1949, pp. 52–55.

[17] Lutjen, G. P., Another Step in Jet Piercing: Eng. and Min. Jour., vol. 150, No. 8, August 1949, pp. 64–65.

[18] Ash, S. H., Eaton, W. L., Hughes, Karl, Romischer, W. M., and Westfield, J., Water Pools in Pennsylvania Anthracite Mines: Bureau of Mines Tech. Paper 727, 1949, 78 pp.

[19] Fatzinger, R. W., Safety Practices in Dredging and Hydraulic Mining: Bureau of Mines Bull. 470, 1949, 76 pp.

[20] Cash, Frank E., Accident Experience at Iron-Ore Mines, Lake Superior District 1940–47: Bureau of Mines Inf. Circ. 7510, 1949, 16 pp.

[21] Harrington, D., and Warncke, R. G., Hazards of Black Blasting Powder in Underground Coal Mining: Bureau of Mines Inf. Circ. 7492, 1949, 29 pp.
Tournay, W. E., Bower, F. M., and Brown, F. W., Safety and Performance Characteristics of Liquid-Oxygen Explosives: Bureau of Mines Bull. 472, 1949, 88 pp.

[22] Brunot, H. B., Permissible Mine Equipment Approved During the Calendar Years 1947–49: Bureau of Mines Inf. Circ. 7569, 1950, 16 pp.

[23] Tartaron, Francis X., Iron Ore Beneficiation: Min. Eng., vol. 1, No. 5, May 1949, sec. 1, pp. 14–18.

[24] Doherty, J. D., Synthetic Liquid Fuels from Coal: Min. Eng., vol. 1, No. 4, min. transact. sec., pp. 116–124.
Hirst, L. L., Markovits, J. A., Skinner, L. C., Dougherty, R. W., and Donath, E. E., Estimated Plant and Operating Costs for Producing Gasoline by Coal Hydrogenation: Bureau of Mines Rept. of Investigations 4564, 1949, 83 pp.
Hirst, L. L., Skinner, L. C., and Donath, E. E., Improvements in Hydrogenation of Coal: Bureau of Mines Inf. Circ. 7486, 1949, 7 pp.

[25] Deaton, W. M., and Frost, E. M., Jr., Gas Hydrates and Their Relation to the Operation of Natural-Gas Pipe Lines: Bureau of Mines Monograph 8, 1949, 101 pp.

WORLD REVIEW

World outputs of cement, natural gas, and phosphate rock were at all-time highs in 1949, and those of iron, gold, and lead were somewhat greater than in 1948. However, production of petroleum, bauxite, and native sulfur were 1 to 2 percent less than in 1948, and that of coal and copper 4 to 5 percent less.

Western Hemisphere.—The Canadian iron ore situation [26] and a review of the Dominion's mining laws [27] were published. Coal reserves on the Pacific Coast of Mexico were estimated at 2 to 4 million tons.[28] The chief problem in use of Brazilian iron ore continued to be transportation.[29] Reports were made on the manganese (Serra do Navio district)[30] and coal [31] resources of Brazil. Coal in Chile also was studied.[32] The July 1949 issue of Engineering and Mining Journal contained brief articles on iron ore in Labrador and Venezuela and on copper, lead, and zinc in Newfoundland, Peru, Chile, and Argentina.

[26] DeMille, John B., Canada's Future Brightens As Producers of Iron Ore: Eng. and Min. Jour., vol 150, No. 4, April 1949, pp. 90-91.
[27] Du Vivier, Paul F., Mining Laws of the Dominion of Canada: Bureau of Mines, Mineral Trade Notes, special supplement 32, July 1949, 8 pp.
[28] Wilson, I. F., and Rocha, V. S., Coal Deposits of the Santa Clara District, Sonora, Mexico. Geol. Surv. Bull. 962-A, 1949, pp. 1-80.
[29] Hughlett, Lloyd J., Getting at Itabira's Iron: Eng. and Min. Jour., vol. 150, No. 10, October 1949, pp. 76-79.
[30] Dorr, J. Van N. II, Park, C. F., Jr., and De Paiva, Glycon: Manganese Deposits of the Serra do Navio District, Territory of Amapa, Brazil: Geol. Surv. Bull. 964-A, 1949, pp. 1-51.
[31] Good, John E., Abreu, Alvaro, and Fraser, Thomas, The Coal Industry of Brazil, part I, General Economy, Production, and Marketing: Bureau of Mines Tech. Paper 713, 1949, 38 pp.
[32] Toenges, Albert L., Kelly, Leon W., Davis, J. D., Reynolds, D. A., Fraser, Thomas, Crentz, W. L., and Abernethy, R. F., Coals of Chile: Bureau of Mines Bull. 474, 1949, 106 pp.

TABLE 15.—Comparison of world and United States production of principal minerals and metals, 1948–49

[Compiled by Berenice B. Mitchell, Pauline Roberts, and Helen Hunt]

Mineral	1948			1949		
	World	United States		World	United States	
	Thousand metric tons		Percent of world	Thousand metric tons		Percent of world
Fuels:						
Anthracite	128,520	51,836	40	125,571	38,738	31
Bituminous coal and lignite	1,577,480	543,871	34	1,506,429	394,623	26
Natural gas (consumption) million cubic meters	157,000	138,000	88	(1)	(1)	(1)
Petroleum, crude thousand barrels	3,433,021	2,020,185	59	3,398,788	1,840,307	54
Nonmetallic minerals (other):						
Asbestos	995	34	3	895	39	4
Cement	99,446	35,626	36	111,300	36,313	33
Diamonds thousand carats	10,047	(2)	(3)	13,635	(2)	(3)
Fluorspar	796	301	38	660	215	33
Graphite [4]	139	9	6	150	6	4
Gypsum [4]	16,500	6,581	40	16,425	5,995	36
Mica [4]	75	47	63	63	30	48
Nitrogen, agricultural fiscal year	2,918	905	31	3,311	975	29
Phosphate rock	18,493	8,808	48	19,412	9,131	47
Potash K_2O equivalent	3,500	1,034	30	3,600	1,015	28
Pyrites	9,500	943	10	10,500	906	9
Salt, common [4]	42,448	14,881	35	(1)	14,144	(1)
Sulfur, native thousand long tons	5,300	4,869	92	5,200	4,745	91
Metals—mine basis:						
Aluminum ore (bauxite)	8,336	1,481	18	8,264	1,167	14
Antimony [4] Sb content	41	5	12	34	1	3
Chromium ore (chromite)	2,105	3	(3)	1,859	(5)	(3)
Copper Cu content	2,332	757	32	2,235	683	31
Gold thousand troy oz. Au	29,700	2,025	7	30,600	1,922	6
Iron ore	216,000	102,625	48	218,000	86,301	40
Lead Pb content	1,354	354	26	1,446	372	26
Manganese ore	4,133	119	3	4,530	114	3
Mercury thousand flasks Hg	102	14	14	112	10	9
Nickel Ni content	151	1	1	146	1	1
Platinum group thousand troy oz. Pt, Pd, etc.	529	19	4	600	25	4
Silver thousand troy oz. Ag	172,000	39,228	23	164,500	34,945	21
Tin [4] thousand long tons Sn	153	(6)	(3)	162	(7)	(3)
Tungsten ore 60 percent WO_3	34	4	12	(1)	3	(1)
Zinc Zn content	1,725	572	33	1,770	538	30
Metals—smelter basis:						
Aluminum	1,268	566	45	1,308	547	42
Copper	2,394	840	35	2,403	780	32
Iron, pig (including ferro-alloys)	113,000	56,214	50	115,000	49,775	43
Lead	1,350	363	27	1,563	432	28
Magnesium	19	9	47	22	11	50
Tin [4] thousand long tons	158	37	23	169	36	21
Zinc	1,692	715	42	1,810	739	41

[1] Data not available.
[2] 246 carats in 1948–49.
[3] Less than 0.5 percent.
[4] Exclusive of U. S. S. R.
[5] 393 tons.
[6] 5 tons.
[7] 68 tons.

Europe and Africa.—Half of the iron smelted by the United Kingdom is from its own ores, which contain only 19 to 33 percent Fe.[33] The European economy benefited from increased output of Polish coal.[34] The mineral resources of the United Kingdom, Greece, Norway, Sweden, and Finland were described in 1949 in Engineering and Mining Journal (January and March issues), and the same magazine (July issue) reported the progress of lead-zinc mining in French Morocco and South-West Africa. The accident rate at South African gold mines has been reduced.[35] The occurrence of uranium, despite its low concentration, in Witwatersrand gold ores is important because of the magnitude of operations.

Asia.—The Matsuo sulfur mine in Japan is in a deposit comparable in size to the Rio Tinto orebody in Spain.[36] Safety conditions in Japanese coal mines were examined.[37] Descriptions were published of the aluminum industry in Japan, Korea, Manchuria, and Formosa,[38] and of tin mining in Malaya[39] and Indonesia.[40]

Reserves.—Only North America and Europe have great unmined reserves of coal and iron together, as shown in table 16. North America, unlike Europe, shares with Asia most of the known petroleum resources. The Western Hemisphere is notably deficient in manganese and tin. At least one-fourth of the specified major nonferrous-metal reserves are in these continents: North America, copper, lead, and zinc; South America and Africa, copper; Europe, none; Asia, bauxite and tin; Oceania, lead.

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[33] Howat, David D., Britain's Iron Mines Also Have Their Problems: Eng. and Min. Jour., vol. 150, No. 5, May 1949, pp. 74–77.
Howat, David D., Britain Gets Half Its Iron From Its Lean Ores: Eng. and Min. Jour., vol. 150, No. 6, June 1949, pp. 66–69.

[34] Mining Engineering, Polish Coal Mining Rejuvenated: Vol. 1, No. 2, February 1949, sec. 1, pp. 25–28.

[35] Lawless, J. M., "Safety First" on the Rand Pays Dividends: Eng. and Min. Jour., vol. 150, No. 4, April 1949, pp. 94–98.

[36] Merrill, Pomeroy C., Matsuo Sulfur Mine May Become an Open Pit: Eng. and Min. Jour., vol. 150, No. 1, January 1949, pp. 72–75.

[37] Warncke, Russell G., Observations of Safety Practices and Conditions in Japanese Coal Mines: Bureau of Mines Inf. Circ. 7542, 1949, 38 pp.

[38] Allen, Glenn, L., and Miller, Virgil, The Japanese Aluminum Industry: Bureau of Mines Inf. Circ. 7496. 1949, 56 pp.

[39] Hughes, A. D., Alluvial Tin Mining in Malaya: Min. Eng., vol. 1, No. 3, March 1949, min. transact. sec., pp. 65–74.

[40] Van Den Berg, J., N. E. I. Tin Mining Resumed: Min. Eng., vol. 1, No. 2, February 1949, sec. 1, pp. 19–24.

TABLE 16.—Estimated reserves of nine major minerals in 1948, by countries, in percent of world tonnages [1]

Country	Fuels		Ferrous ores		Nonferrous metals				
	Coal [2]	Petroleum	Iron	Manganese	Copper	Bauxite	Lead	Zinc	Tin
North America:									
Canada	1	1	7	-	7	-	10	11	-
Mexico	-	1	-	-	-	-	1	1	-
United States	47	36	34	1	20	2	18	28	-
Other North America	1	-	8	1	-	20	2	-	-
South America:									
Republics	-	13	9	4	28	2	9	10	8
Other South America	-	-	1	-	-	7	-	-	-
Europe: [3]									
France	-	-	5	-	-	3	-	-	-
Germany	7	-	1	1	-	-	6	4	-
U. S. S. R.[3]	24	6	11	58	10	2	6	8	3
United Kingdom	4	-	5	-	-	-	-	-	1
Other Europe	2	1	4	2	2	13	6	11	-
Africa:									
Belgian	-	-	-	-	10	-	-	3	8
British Commonwealth	5	-	4	10	20	12	6	3	2
French	-	-	1	4	-	10	-	-	-
Other Africa	-	-	-	1	-	1	-	-	-
Asia: [3]									
China	7	-	1	3	1	9	1	1	23
India	2	-	7	13	-	15	-	-	-
Japan	-	-	-	-	-	-	1	2	-
Other Asia	-	42	2	2	1	2	2	1	54
Oceania:									
Australia	-	-	-	-	1	2	32	17	1
World total	100	100	100	100	100	100	100	100	100

[1] Although partly modified according to later data, the percentages were calculated principally from tonnages tabulated in the following references:

Brown, Frederick (ed.), Statistical Year-Book 4 of the World Power Conference, London, 1948, pp. 21–25.
DeGolyer, E., Global Oil Reserves: Oil and Gas Jour., vol. 47, No. 35, Dec. 30, 1948, pp. 144–146.
Mikami, Harry M., World Iron-Ore Map: Econ. Geol., vol. 39, No. 1, January-February 1944, pp. 22–23.
Kostov, Ivan, The World's Manganese Ore: Mining Mag. (London), vol. 72, No. 5, May 1945, p. 266.
Shea, William P., Foreign Ore Reserves of Copper, Lead, and Zinc: Eng. and Min. Jour., vol. 148, No. 1, January 1947, pp. 53–58.
War Production Board Special Aluminum Committee, The World Aluminum Industry: April 1945, p. 105. Reprinted in Surplus Property Board Report to Congress, Aluminum Plants and Facilities, Sept. 21, 1945, pp. 125–126.
Croston, John J., Siam's Mining Industry Offers New Opportunities: Eng. and Min. Jour., vol. 147, No. 12, December 1946, p. 64.

[2] Excludes lignite.

[3] U. S. S. R. in Asia included with U. S. S. R. in Europe.

Statistical Summary of Mineral Production

By John Hozik and K. Joyce D'Amico

GENERAL SUMMARY

PRESENTATION of the mineral statistics in this report represents a departure from the procedure followed in earlier years. The basis of the statistical series comprising the State production tables was little changed; but application of that basis to the national production tables, in the interest of uniformity, entailed a major revision in the United States totals. A detailed explanation of the new and old statistical series follows.

Coverage.—Statistics used in this chapter to derive total mineral production of the United States and of individual States represent primary products only and exclude products from scrap. The figures on the new basis given in table 1 for 1947–49 pertain to production exclusively from domestic mines; statistics on the old basis in some instances include mineral products made from material of foreign origin.

The value of United States mine output, as now constituted, is limited geographically to the 48 States and the District of Columbia. Heretofore, the value of United States mineral output included production in Alaska, Hawaii, Philippine Islands (through 1945), and Puerto Rico, but no statistics were collected for other United States possessions. In this report separate data for the Territories of Alaska and Hawaii and for the possessions of the United States are given in tables 6 and 7. A summary of mineral output in States, Territories, and possessions appears in table 8. Mineral waters are excluded from the new 1947–49 series, inasmuch as the Standard Commodity Classification considers mineral water a beverage rather than a mineral product.

Stage of Production Measured.—The aim of this report is to present national and State total values representing mine output (or the output of concentrating mills at or near the mine). The value of the fuels, nearly all the nonmetallic minerals, and iron are so measured at the mine, but comparable data for most nonferrous metals are not available. The mineral products valued at the refined stage of production rather than at the mine are cement, lime, antimony, copper, gold, lead, mercury, silver, tin, and zinc.

Revisions in State Tables.—The State tables for 1947–49 in this report differ in basis from preceding editions in that the heavy clay-products statistical series has been replaced by a clay series, and estimates have been added for natural carbon dioxide and gem stones.

Revisions in National Tables.—The following changes in the basis of the 1947–49 United States tables were made for comparability with the State tables: Natural gas is valued at wells rather than at points of consumption. The clay series is modified to replace heavy clay products. An estimate for natural carbon dioxide was added. The series for aluminum, pig iron, magnesium, nickel, and refined platinum-group metals were replaced, respectively, by bauxite, iron ore, magnesium chloride, nickel ore, and crude platinum-group metals. Antimonial lead, ferro-alloys, mineral pigments, and byproduct sulfuric acid were deleted to eliminate duplication, and arsenic, bismuth, cadmium, germanium, indium, radium, selenium, tellurium, and thallium were omitted because they are smelter and refinery byproducts that seldom if ever affect (except indirectly) the price paid for the nonferrous ores in which they are contained in low concentrations. The quantities of copper, gold, lead, silver, and zinc are mine outputs rather than smelter, refinery, or mint production; the unit values applied to these mine volumes to derive values, however, continue to be the average weighted price of all grades of primary refined metal sold by producers.

Although the new basis that applies to 1949 was revised back only 2 years, it is intended to revise earlier years so that a long-term comparable series will be available.

Units of Measurement.—In expressing quantities of minerals, the Bureau of Mines has adopted the weight or volume units commonly employed by each individual industry. The unit of value is the United States dollar. No adjustment is made for fluctuations in the purchasing power of the dollar.

TABLE 1.—Value of mineral production in the United States, 1880–1945 (5-year intervals) and 1946–49

Year	Nonmetallic			Metallic	Grand total
	Fuels	Other	Total		
1880	$120, 241, 000	$56, 341, 000	$176, 582, 000	$190, 881, 000	$367, 463, 000
1885	183, 075, 000	61, 758, 000	244, 833, 000	174, 718, 000	419, 551, 000
1890	230, 962, 000	80, 530, 000	311, 492, 000	303, 937, 000	615, 429, 000
1895	268, 438, 000	125, 720, 000	394, 158, 000	248, 533, 000	642, 691, 000
1900	406, 376, 000	188, 328, 000	594, 704, 000	514, 232, 000	1, 108, 936, 000
1905	602, 258, 000	318, 722, 000	920, 980, 000	702, 785, 000	1, 623, 765, 000
1910	828, 213, 000	409, 604, 000	1, 237, 817, 000	750, 027, 000	1, 987, 844, 000
1915	972, 617, 000	428, 674, 000	1, 401, 291, 000	993, 353, 000	2, 394, 644, 000
1920	4, 192, 910, 000	1, 024, 755, 000	5, 217, 665, 000	1, 763, 675, 000	6, 981, 340, 000
1925	3, 058, 680, 000	1, 236, 795, 000	4, 295, 475, 000	1, 382, 155, 000	5, 677, 630, 000
1930	2, 764, 500, 000	1, 014, 510, 000	3, 779, 010, 000	985, 790, 000	4, 764, 800, 000
1935	2, 330, 000, 000	586, 870, 000	2, 916, 870, 000	733, 130, 000	3, 650, 000, 000
1940	3, 116, 500, 000	818, 800, 000	3, 935, 300, 000	1, 678, 600, 000	5, 613, 900, 000
1945	5, 212, 000, 000	954, 000, 000	6, 166, 000, 000	1, 975, 000, 000	8, 141, 000, 000
1946	5, 760, 000, 000	1, 311, 000, 000	7, 071, 000, 000	1, 825, 000, 000	8, 896, 000, 000
1947	7, 941, 000, 000	1, 634, 000, 000	9, 575, 000, 000	2, 909, 000, 000	12, 484, 000, 000
1948	10, 362, 000, 000	1, 894, 000, 000	12, 256, 000, 000	3, 510, 000, 000	15, 766, 000, 000
NEW BASIS					
1947	$7, 181, 000, 000	$1, 345, 000, 000	$8, 526, 000, 000	$1, 084, 000, 000	$9, 610, 000, 000
1948	9, 495, 000, 000	1, 559, 000, 000	11, 054, 000, 000	1, 219, 000, 000	12, 273, 000, 000
1949	7, 886, 000, 000	1, 567, 000, 000	9, 453, 000, 000	1, 101, 000, 000	10, 554, 000, 000

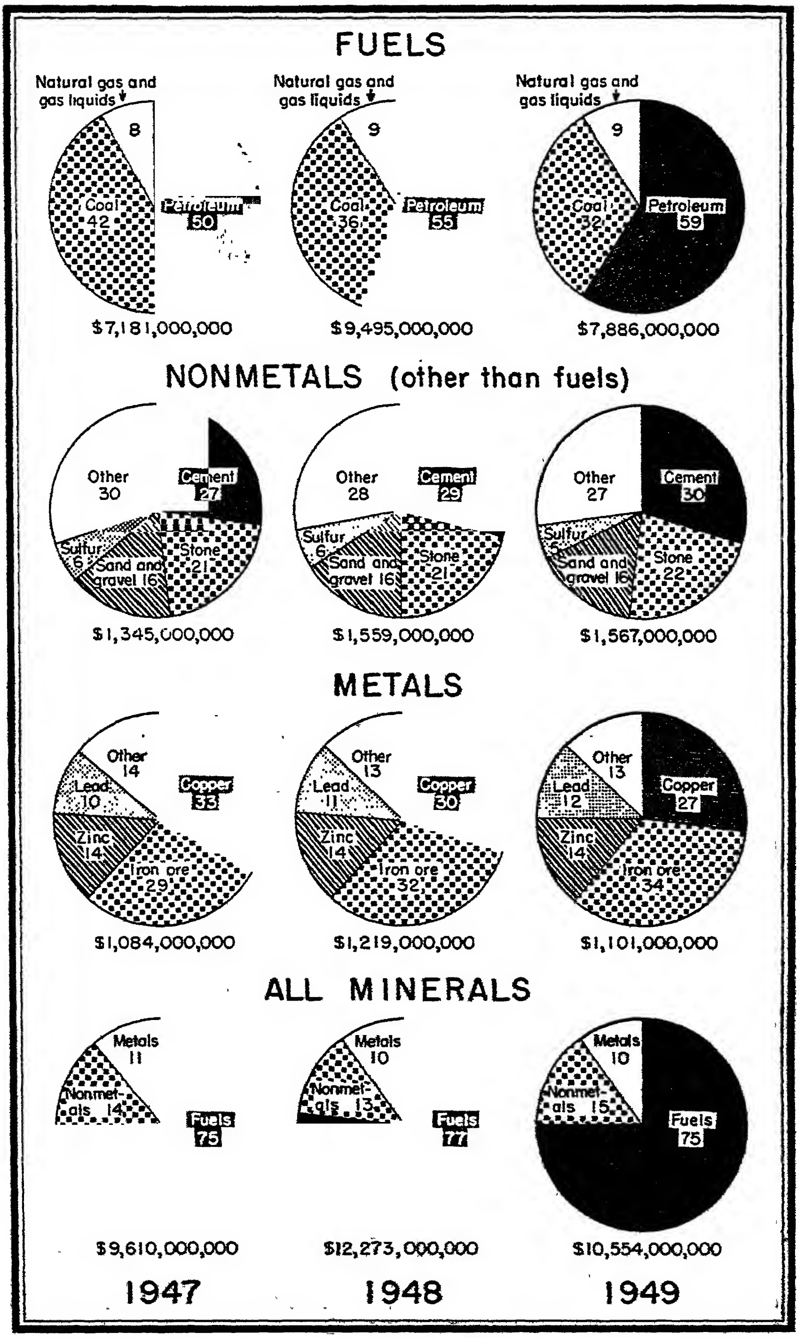

FIGURE 1.—Value of mineral production in continental United States, 1947–49, by mineral groups and by minerals, in percent.

TABLE 2.—Mineral production in continental United States, 1947–49 [1]

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
MINERAL FUELS						
Coal:						
Bituminous [2]	627,388,849	$2,614,560,847	596,024,437	$2,983,465,256	434,342,373	$2,126,225,715
Lignite	2,873,653	5,519,302	3,085,886	7,012,490	3,092,130	7,335,553
Pennsylvania anthracite	57,190,009	413,019,486	57,139,948	407,051,800	42,701,724	358,008,451
Natural gas (valued at wells) thousand cubic feet	4,582,173,000	274,709,000	5,148,020,000	333,173,000	5,486,582,000	355,472,000
Natural-gas liquids:						
Natural gasoline and cycle products gallons	3,659,449,000	228,174,000	3,953,216,000	341,154,000	4,142,110,000	273,680,000
LP-gases do	1,891,818,000	66,820,000	2,209,071,000	117,823,000	2,418,436,000	98,464,000
Petroleum barrels, 42 gallons	1,856,987,000	3,577,890,000	2,020,185,000	5,245,080,000	1,840,307,000	4,667,480,000
Total mineral fuels		7,181,000,000		9,495,000,000		7,886,000,000
NONMETALLIC MINERALS (EXCEPT FUELS)						
Abrasive stone: [3]						
Grindstones and pulpstones	10,696	481,787	7,954	404,767	4,507	246,679
Millstones	(4)	23,189	(4)	17,733	(4)	9,400
Pebbles (grinding)	5,860	122,883	4,026	101,583	2,374	64,038
Tube-mill liners (natural)	1,496	40,303	1,297	41,555	1,166	47,093
Asbestos	24,035	918,558	37,092	1,806,261	43,387	2,614,416
Asphalt and related bitumens (native):						
Bituminous limestone and sandstone	1,004,740	3,756,074	1,084,004	3,634,917	1,150,931	4,264,989
Gilsonite	67,165	1,740,228	52,122	1,390,713	51,462	1,303,584
Wurtzilite	17	746	----	----	----	----
Barite (crude)	834,082	6,171,342	799,848	6,603,418	717,313	5,642,226
Boron minerals	501,935	11,844,108	450,932	11,147,735	467,592	11,511,893
Bromine pounds	78,177,650	14,837,104	76,047,551	[5] 14,825,470	88,725,709	16,267,908
Calcium-magnesium chloride, basis 75 percent (Ca, Mg) Cl_2	271,206	2,650,205	[5] 309,660	[5] 3,906,858	255,797	3,260,675
Carbon dioxide, natural (estimated) thousand cubic feet	581,000	412,000	545,000	397,000	489,000	376,000
Cement barrels, 376 pounds net	188,515,629	356,638,993	205,239,342	446,465,335	207,142,364	475,074,352
Clays (including fuller's earth) [6]	[6] 28,191,690	[6] 71,250,418	[6] 31,303,697	[6] 80,996,834	[6] 28,473,844	[6] 74,618,654
Emery	5,798	66,927	5,405	69,408	4,909	60,917
Feldspar (crude) long tons	459,910	2,410,940	460,713	2,564,387	369,378	2,278,441
Fluorspar	329,484	10,954,875	331,749	11,227,452	236,704	8,266,754
Garnet (abrasive)	8,722	614,071	8,039	587,797	6,578	505,231
Gem stones (estimated)	(4)	540,000	(4)	450,000	(4)	450,000
Graphite	5,207	221,260	9,871	450,759	5,213	475,264
Gypsum (crude)	6,208,216	16,529,884	7,254,535	19,112,669	6,608,118	18,318,553
Helium (shipments, calendar years) cubic feet	52,322,350	500,576	50,915,346	610,196	51,501,421	688,795
Kyanite	(7)	(7)	14,552	527,042	12,115	403,169

Lime (open-market)	6,759,949	63,363,195	7,245,211	74,677,460	6,302,551	68,907,830
Lithium minerals	2,441	151,113	3,881	210,792	4,838	345,970
Magnesite (crude)	375,993	2,596,747	(7)	(7)	287,315	1,950,163
Magnesium compounds from sea water and brines (except for metal) MgO equivalent	89,500	5,840,000	91,700	6,918,000	63,000	5,033,000
Marl:						
Calcareous (except for cement)	176,187	235,190	114,759	145,712	166,800	231,975
Greensand	8,337	432,980	7,269	392,959	6,128	276,504
Mica:						
Scrap	49,797	1,095,578	52,157	1,091,698	32,856	795,782
Sheet pounds	415,589	116,110	270,042	45,940	513,994	132,097
Olivine	10,838	129,094	4,766	86,230	3,528	56,850
Peat	136,232	868,979	129,581	929,560	129,532	1,020,014
Phosphate rock long tons	9,027,030	46,638,837	8,668,769	50,501,598	8,986,933	51,415,027
Potassium salts K_2O equivalent	1,053,266	34,716,051	1,148,339	35,998,758	1,120,653	35,105,799
Pumice and pumicite	442,552	2,021,880	607,646	2,500,906	716,742	2,369,082
Pyrites long tons	940,652	4,070,000	928,531	3,950,000	888,388	3,904,000
Quartz from pegmatites and quartzite	101,317	424,525	161,861	750,667	107,552	475,491
Salt (common)	16,040,538	52,090,401	16,388,148	54,219,710	15,578,033	53,970,904
Sand and gravel	288,188,524	212,567,819	318,069,684	252,244,195	315,895,407	245,660,928
Sand and sandstone (ground)	644,508	5,154,264	692,773	5,778,277	610,789	5,258,464
Slate	876,010	11,685,554	799,400	12,880,929	740,260	12,164,276
Sodium carbonate (natural)	293,051	5,862,178	[8] 288,769	[8] 6,623,280	200,406	4,163,714
Sodium sulfate (natural)	267,294	3,329,094	265,862	4,248,613	186,223	2,733,853
Stone [9]	206,242,320	286,792,050	224,474,900	326,660,222	222,548,750	339,442,316
Sulfur:						
Ore for direct agricultural use long tons	4,303	65,124	1,700	30,220	5,392	101,991
Refined do	4,828,103	85,200,000	4,978,912	89,600,000	4,789,311	86,208,000
Talc, pyrophyllite, and ground soapstone	516,094	7,682,481	518,746	8,265,363	461,896	7,523,478
Topaz (industrial)	2,294	45,873	200	4,000	(7)	(7)
Tripoli	84,578	751,422	26,845	705,523	25,525	690,564
Vermiculite	131,385	1,338,572	138,635	1,387,233	168,819	1,686,410
Wollastonite	80	1,600	75	1,500	500	7,000
Other nonmetallic minerals [10]		7,352,623		10,639,850		8,348,612
Total nonmetallic minerals		1,345,000,000		1,559,000,000		1,567,000,000
METALS						
Antimony ore and concentrates gross weight	19,980	3,256,023	16,171	4,349,062	5,186	1,134,417
Bauxite long tons, dried equivalent	1,202,055	6,884,666	1,457,148	8,696,708	1,148,792	6,778,181
Beryllium concentrates gross weight	145	25,214	99	26,600	346	111,073
Chromite do	948	(11)	3,619	(11)	433	11,662
Cobalt pounds, Co content	676,612	(11)	580,703	(11)	673,773	(11)
Columbium (niobium) concentrates pounds, gross weight			100	(11)		
Copper Cu content	847,551	355,971,420	834,797	362,301,898	752,746	296,581,924
Gold troy ounces, Au content	1,829,197	64,021,895	1,765,862	61,805,170	1,762,367	61,682,845
Iron ore, usable (excluding byproduct iron sinter) long tons, gross weight	92,670,188	317,628,811	100,274,965	391,229,884	84,174,399	377,037,131
Lead Pb content	383,957	110,579,616	390,147	139,672,626	409,857	129,514,812
Manganese ore (35 percent or more Mn) gross weight	131,627	4,200,947	131,100	4,390,199	126,135	5,178,564

Footnotes at end of table, p. 34.

TABLE 2.—Mineral production in continental United States, 1947–49 [1]—Continued

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
METALS—continued						
Manganiferous ore (5 to 35 percent Mn)....gross weight..	1,174,355	$3,447,149	1,340,565	(11)	1,078,395	$4,040,155
Manganiferous residuum....do....	227,547	(11)	291,383	(11)	158,902	(11)
Mercury....flasks (76 pounds), Hg content..	23,117	1,936,818	14,288	$1,092,889	9,830	781,092
Molybdenum ore and concentrates....pounds, Mo content..	22,189,800	15,178,000	29,669,000	20,418,000	23,280,000	19,332,000
Platinum group (crude)....troy ounces, metals content..	324	(11)	272	(11)	(11)	(11)
Silver....troy ounces, Ag content..	35,757,413	32,360,459	38,028,690	34,417,884	34,638,896	31,349,949
Tantalum concentrates....pounds, gross weight..	3,259	8,677	500	(11)		
Tin ore and concentrates....long tons, Sn content..			(12)	(11)	17	37,410
Titanium concentrates:						
Ilmenite....gross weight..	336,061	5,029,490	381,508	5,793,973	389,234	6,212,348
Rutile....do....	5,157	533,548	9,907	647,334	10,559	489,798
Tungsten concentrates....60-percent WO_3 basis..	3,081	4,330,383	4,033	6,355,386	2,765	4,377,066
Vanadium ore and concentrates....pounds, V content..	2,117,962	1,285,026	(11)	(11)	(11)	(11)
Zinc....Zn content..	637,683	153,112,356	629,955	167,973,567	593,201	148,912,878
Other metals [13]....		3,876,513		10,467,595		6,670,946
Total metals....		1,084,000,000		1,219,000,000		1,101,000,000
Grand total mineral production....		9,610,000,000		12,273,000,000		10,554,000,000

[1] Production as measured by mine shipments or mine sales (including consumption by producers), except that fuels and the following additional minerals are strictly production: Gypsum, iodine, magnesite, pyrites, antimony, bauxite, and mercury. The 1949 figures for natural gas, natural-gas liquids, and petroleum are preliminary. Excludes uranium ores.

[2] Includes small quantity of anthracite mined in States other than Pennsylvania.

[3] Excludes sharpening stones, which are included with "Other nonmetallic minerals."

[4] Weight not recorded.

[5] Revised figure.

[6] Excludes clays sold or used for cement as follows: 1947—5,336,492 short tons, $2,987,424; 1948—6,362,459 tons, $4,320,266; 1949—6,676,134 tons, $4,572,797.

[7] Value included with "Other nonmetallic minerals."

[8] Excludes production from Wyoming, value for which is included with "Other nonmetallic minerals."

[9] Excludes abrasive stone, bituminous limestone, bituminous sandstone, and ground soapstone, all included elsewhere in table. Also excludes limestone for cement and lime.

[10] Comprises andalusite, aplite, brucite, diatomite, dumortierite (1949), epsom salts from serpentine (1947) and epsomite (1949), iodine, perlite, sharpening stones, sodium carbonate (Wyoming 1948), and minerals indicated by footnote 7.

[11] Value included with "Other metals."

[12] Less than ½ ton.

[13] Comprises magnesium chloride for magnesium metal, zirconium concentrates, and minerals indicated by footnote 11.

TABLE 3.—Minerals produced in continental United States and principal producing States in 1949

Rank in value	Mineral	Principal producing States: In order of quantity	Principal producing States: In order of value
	Abrasive stone:		
69	Grindstones and pulpstones	Ohio, West Virginia, Washington	Rank same as for quantity.
82	Millstones	Not available	North Carolina, Virginia.
74	Pebbles (grinding)	Minnesota, Wisconsin, Texas, North Carolina	Rank same as for quantity.
77	Tube-mill liners (natural)	Minnesota, North Carolina, Wisconsin	Minnesota, Wisconsin, North Carolina.
86	Andalusite	Nevada	Rank same as for quantity.
50	Antimony ore and concentrates	Idaho, Nevada, Oregon, Washington	Do.
67	Aplite	Virginia	Do.
41	Asbestos	Vermont, Arizona, Georgia, California	Do.
31	Asphalt (native)	Texas, Kentucky, Alabama, Oklahoma	Texas, Kentucky, Utah, Alabama.
30	Barite (crude)	Arkansas, Missouri, Nevada, Georgia	Arkansas, Missouri, Georgia, Nevada.
27	Bauxite	Arkansas, Georgia, Alabama	Rank same as for quantity.
72	Beryllium concentrates	New Hampshire, Colorado, South Dakota, New Mexico	Do.
24	Boron minerals	California	Do.
22	Bromine	Texas, Michigan, California, West Virginia	Texas, Michigan, West Virginia, California.
66	Brucite	Nevada	Rank same as for quantity.
39	Calcium-magnesium chloride	Michigan, West Virginia, California, Ohio	Michigan, California, West Virginia, Ohio.
64	Carbon dioxide (natural)	California, Utah, New Mexico, Oregon	California, Oregon, Washington, Utah.
3	Cement	Pennsylvania, California, Texas, New York	Rank same as for quantity.
81	Chromite	California	Do.
13	Clays	Ohio, Pennsylvania, California, Illinois	Georgia, Pennsylvania, Ohio, Missouri.
2	Coal:		
	Bituminous	West Virginia, Pennsylvania, Kentucky, Illinois	Rank same as for quantity.
	Lignite	North Dakota, Texas, Montana, South Dakota	North Dakota, Montana, South Dakota, Texas.
	Pennsylvania anthracite	Pennsylvania	Rank same as for quantity.
70	Cobalt	Pennsylvania	Do.
8	Copper	Arizona, Utah, Montana, New Mexico	Do.
29	Diatomite	California, Oregon, Nevada, Washington	Do.
85	Dumortierite	Nevada	Do.
75	Emery	New York	Do.
83	Epsomite	Washington	Do.
44	Feldspar (crude)	North Carolina, Colorado, Virginia, South Dakota	North Carolina, Colorado, New Hampshire, Virginia.
25	Fluorspar	Illinois, Kentucky, Colorado, New Mexico	Rank same as for quantity.
57	Garnet (abrasive)	New York, Idaho	Do.
61	Gem stones	Not available	Oregon, California, Washington, Texas.
15	Gold	South Dakota, California, Utah, Nevada	Rank same as for quantity.

TABLE 8.—Minerals produced in continental United States and principal producing States in 1949—Continued

Rank in value	Mineral	Principal producing States: In order of quantity	Principal producing States: In order of value
60	Graphite:		
	Amorphous	Rhode Island	Rank same as for quantity.
	Crystalline	Texas, Alabama	Do.
21	Gypsum (crude)	Michigan, New York, Iowa, Texas	Do.
55	Helium	Texas	Do.
49	Iodine	California	Do.
4	Iron ore (usable)	Minnesota, Michigan, Alabama, Utah	Minnesota, Michigan, Alabama, New York.
63	Kyanite	Virginia, South Carolina, Georgia	Rank same as for quantity.
11	Lead	Missouri, Idaho, Utah, Arizona	Do.
14	Lime (open-market)	Ohio, Pennsylvania, Missouri, Alabama	Ohio, Pennsylvania, Missouri, West Virginia.
66	Lithium minerals	South Dakota, California	California, South Dakota.
46	Magnesite (crude)	Washington, Nevada, Texas, California	Rank same as for quantity.
45	Magnesium chloride (for magnesium metal)	Texas	Do.
34	Magnesium compounds from sea water and brines (except for metal).	California, Michigan, New Jersey, Texas	Michigan, California, New Jersey, Texas.
33	Manganese ore	Montana, Arkansas, California, Virginia	Montana, Arkansas, Arizona, Tennessee.
37	Manganiferous ore	Minnesota, New Mexico, Arkansas, Montana	Minnesota, New Mexico, Montana, Arkansas.
48	Manganiferous residuum	New Jersey	Rank same as for quantity.
	Marl:		
71	Calcareous	Virginia, Indiana, Wisconsin, West Virginia	Virginia, Indiana, Nevada, West Virginia.
68	Greensand	New Jersey	Rank same as for quantity.
53	Mercury	California, Nevada, Oregon	Do.
52	Mica	North Carolina, Colorado, Pennsylvania, South Dakota	Do.
	Scrap	North Carolina, Colorado, Pennsylvania, South Dakota	Do.
	Sheet	North Carolina, New Hampshire, Georgia, South Dakota	North Carolina, New Hampshire, South Dakota, Georgia.
20	Molybdenum concentrates	Utah, Colorado, New Mexico, Arizona	Colorado, Utah, New Mexico, Arizona.
6	Natural gas	Texas, Louisiana, California, Oklahoma	Texas, California, West Virginia, Louisiana.
5	Natural-gas liquids:		
	Natural gasoline and cycle products	Texas, California, Louisiana, Oklahoma	Rank same as for quantity.
	LP-gases	Texas, California, Oklahoma, Louisiana	Do.
76	Olivine	North Carolina, Washington	Do.
51	Peat	New Jersey, Ohio, Minnesota, Florida	Ohio, New Jersey, Michigan, Maine.
56	Perlite (crude)	Nevada, New Mexico, Colorado, Oregon	Nevada, Oregon, New Mexico, Colorado.
1	Petroleum (crude)	Texas, California, Louisiana, Oklahoma	Rank same as for quantity.
17	Phosphate rock	Florida, Tennessee, Idaho, Montana	Florida, Tennessee, Montana, Idaho.
79	Platinum-group metals (crude)	California	Rank same as for quantity.
18	Potassium salts	New Mexico, California, Utah, Michigan	Do.
43	Pumice and pumicite	New Mexico, California, Oregon, Idaho	Do.

38	Pyrites	Tennessee, Virginia, Montana, California	Tennessee, Virginia, California, Montana.
59	Quartz from pegmatites and quartzite	Washington, North Carolina, Connecticut, Wisconsin	Washington, North Carolina, Connecticut, Arizona.
16	Salt (common)	Michigan, New York, Ohio, Louisiana	Michigan, New York, Louisiana, Kansas.
9	Sand and gravel	California, Michigan, New York, Illinois	California, New York, Illinois, Pennsylvania.
32	Sand and sandstone (ground)	Illinois, New Jersey, West Virginia, Ohio	Illinois, West Virginia, New Jersey, Ohio.
80	Sharpening stones	Arkansas, Indiana, Ohio, New Hampshire	Rank same as for quantity.
19	Silver	Idaho, Utah, Montana, Arizona	Do.
23	Slate	Pennsylvania, Vermont, New York, Maryland	Pennsylvania, Vermont, New York, Virginia.
36	Sodium carbonate (natural)	California	Rank same as for quantity.
40	Sodium sulfate (natural)	California, Texas, Wyoming	Do.
7	Stone	Pennsylvania, Ohio, Illinois, Michigan	Pennsylvania, Ohio, Illinois, New York.
12	Sulfur (refined)	Texas, Louisiana	Rank same as for quantity.
73	Sulfur ore for direct agricultural use	Wyoming, California, Nevada, Colorado	Do.
26	Talc, pyrophyllite, and ground soapstone	New York, North Carolina, California, Vermont	New York, California, North Carolina, Vermont.
78	Tin concentrates	Colorado	Rank same as for quantity.
	Titanium concentrates:		
28	Ilmenite	New York, Florida, North Carolina, Virginia	New York, Florida, Virginia, North Carolina.
58	Rutile	Florida, Virginia	Rank same as for quantity.
87	Topaz (industrial)	South Carolina	Do.
54	Tripoli	Missouri, Illinois, Pennsylvania	Do.
35	Tungsten concentrates	California, North Carolina, Nevada, Colorado	California, Nevada, North Carolina, Colorado.
42	Vanadium concentrates	Colorado, Utah, Idaho, Arizona	Rank same as for quantity.
47	Vermiculite	Montana, South Carolina, North Carolina, Colorado	Do.
84	Wollastonite	New York	Do.
10	Zinc	Idaho, Arizona, Montana, New Jersey	Idaho, Arizona, New Jersey, Montana.
62	Zirconium concentrates	Florida	Rank same as for quantity.

TABLE 4.—Value of mineral production in continental United States, 1947–49, by States, and principal minerals produced in 1949

State	1947	1948	1949 Value	1949 Rank	1949 Percent of United States total	1949 Principal minerals in order of value
Alabama	$158,275,000	$183,797,000	$143,879,000	17	1.36	Coal, iron ore, cement, stone.
Arizona	186,081,000	200,358,000	181,095,000	14	1.72	Copper, zinc, lead, silver.
Arkansas	90,857,000	122,089,000	109,276,000	23	1.04	Petroleum, coal, bauxite, natural-gas liquids.
California	843,413,000	1,146,411,000	1,074,416,000	2	10.18	Petroleum, natural-gas liquids, natural gas, cement.
Colorado	102,449,000	128,861,000	141,165,000	18	1.34	Petroleum, coal, zinc, molybdenum concentrates.
Connecticut	3,863,000	4,484,000	4,887,000	45	.05	Stone, sand and gravel, lime, clays.
Delaware	340,000	408,000	335,000	48	----------	Sand and gravel, stone, clays.
District of Columbia	61,000	64,000	63,000	49	----------	Clays.
Florida	45,847,000	53,664,000	54,998,000	28	.52	Phosphate rock, cement, stone, sand and gravel.
Georgia	32,009,000	36,103,000	35,508,000	34	.34	Clays, stone, cement, sand and gravel.
Idaho	66,822,000	79,128,000	64,292,000	27	.61	Lead, zinc, silver, gold.
Illinois	425,380,000	521,038,000	450,008,000	7	4.26	Coal, petroleum, stone, cement.
Indiana	133,862,000	161,950,000	140,676,000	19	1.33	Coal, petroleum, cement, stone.
Iowa	31,023,000	35,955,000	37,458,000	31	.35	Cement, stone, coal, sand and gravel.
Kansas	265,061,000	361,180,000	335,699,000	9	3.18	Petroleum, cement, natural gas, coal.
Kentucky	426,101,000	504,080,000	375,400,000	8	3.56	Coal, petroleum, natural gas, stone.
Louisiana	404,779,000	604,198,000	616,245,000	5	5.84	Petroleum, natural-gas liquids, natural gas, sulfur.
Maine	5,784,000	8,094,000	6,742,000	44	.06	Cement, stone, sand and gravel, slate.
Maryland	23,201,000	25,002,000	20,461,000	37	.19	Sand and gravel, cement, coal, stone.
Massachusetts	10,576,000	12,583,000	12,449,000	40	.12	Stone, sand and gravel, lime, clays.
Michigan	166,634,000	202,885,000	200,447,000	12	1.90	Iron ore, petroleum, cement, salt.
Minnesota	218,374,000	267,248,000	257,540,000	10	2.44	Iron ore, stone, sand and gravel, manganiferous ore.
Mississippi	67,644,000	119,317,000	103,984,000	24	.99	Petroleum, natural gas, natural-gas liquids, clays.
Missouri	103,928,000	108,291,000	111,287,000	22	1.05	Lead, cement, coal, stone.
Montana	87,735,000	103,841,000	97,756,000	25	.93	Petroleum, copper, zinc, coal.
Nebraska	6,704,000	8,385,000	10,102,000	41	.10	Cement, sand and gravel, stone, petroleum.
Nevada	40,923,000	42,479,000	37,376,000	32	.35	Copper, zinc, gold, lead.
New Hampshire	1,254,000	1,331,000	1,384,000	46	.01	Sand and gravel, stone, feldspar, beryllium concentrates.
New Jersey	38,433,000	44,388,000	38,584,000	30	.37	Zinc, stone, sand and gravel, iron ore.
New Mexico	157,548,000	220,075,000	199,629,000	13	1.89	Petroleum, potassium salts, copper, natural-gas liquids.
New York	122,333,000	143,623,000	138,265,000	20	1.31	Cement, iron ore, stone, petroleum.
North Carolina	16,386,000	18,231,000	19,755,000	38	.19	Stone, sand and gravel, talc and pyrophyllite, clays.
North Dakota	6,258,000	8,478,000	8,810,000	43	.08	Coal (lignite), sand and gravel, stone, clays.
Ohio	244,444,000	284,816,000	243,391,000	11	2.31	Coal, stone, cement, lime.
Oklahoma	354,387,000	506,846,000	483,696,000	6	4.58	Petroleum, natural-gas liquids, natural gas, coal.

Oregon	15,867,000	23,935,000	21,849,000	36	.21	Sand and gravel, stone, cement, gold.
Pennsylvania	1,248,817,000	1,386,960,000	1,034,837,000	3	9.81	Coal, cement, petroleum, stone.
Rhode Island	785,000	1,450,000	929,000	47	----	Stone, sand and gravel, graphite.
South Carolina	7,589,000	8,885,000	9,026,000	42	.08	Clays, stone, cement, vermiculite.
South Dakota	23,590,000	24,327,000	26,723,000	35	.25	Gold, stone, sand and gravel, clays.
Tennessee	79,941,000	93,599,000	77,348,000	26	.73	Coal, stone, cement, phosphate rock.
Texas	1,945,634,000	2,830,283,000	2,365,847,000	1	22.42	Petroleum, natural-gas liquids, natural gas, sulfur.
Utah	206,015,000	204,458,000	177,763,000	15	1.68	Copper, coal, lead, gold.
Vermont	14,717,000	15,999,000	17,384,000	39	.17	Stone, slate, asbestos, copper.
Virginia	130,296,000	143,333,000	116,410,000	21	1.10	Coal, stone, cement, sand and gravel.
Washington	38,051,000	48,928,000	40,863,000	29	.39	Cement, sand and gravel, coal, stone.
West Virginia	857,670,000	1,012,402,000	721,480,000	4	6.84	Coal, natural gas, petroleum, stone.
Wisconsin	34,491,000	37,108,000	35,878,000	33	.34	Stone, sand and gravel, iron ore, cement.
Wyoming	117,395,000	172,004,000	150,839,000	16	1.43	Petroleum, coal, natural gas, natural-gas liquids.
Total	9,609,717,000	12,273,317,000	10,554,234,000	----	100.00	Petroleum, coal, cement, iron ore.

TABLE 5.—Mineral production in the United States, 1947–49, by States

ALABAMA

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement [1] ... barrels, 376 pounds net	[1] 9,509,697	[1] $16,663,543	[1] 9,948,600	[1] $20,140,177	[1] 9,394,348	[1] $20,320,658
Clays (except for cement)	853,273	955,357	955,721	1,075,898	856,719	934,262
Coal	19,048,225	104,303,456	18,800,954	115,534,604	12,933,830	79,187,827
Iron ore (usable) ... long tons, gross weight	7,207,556	23,436,620	8,024,052	32,543,713	7,314,204	27,553,175
Lime (open-market)	345,160	2,727,464	388,197	3,275,402	359,446	3,203,564
Peat	----	----	2,034	11,620	----	----
Petroleum (crude) ... barrels, 42 gallons	396,000	(2)	466,000	(2)	[3] 462,000	(2)
Sand and gravel	3,400,103	2,271,534	3,619,469	2,405,901	3,296,582	2,268,013
Stone (except for cement and lime)	2,795,240	4,624,892	2,475,530	4,482,133	2,636,930	6,039,867
Other minerals: Native asphalt, bauxite, puzzolan cement, graphite, mica (1947), and minerals indicated by footnote 2	----	3,292,088	----	4,327,153	----	4,372,078
Total Alabama	----	158,275,000	----	183,797,000	----	143,879,000
Clays sold or used for cement	282,113	141,057	304,428	154,161	328,112	202,308
Coke	5,869,738	47,086,856	6,015,460	57,611,881	5,161,397	55,493,394
Ferro-alloys	132,603	15,030,000	129,615	16,817,011	99,268	14,275,595
Iron, pig	3,928,007	110,436,827	3,980,677	145,358,582	3,664,801	131,162,133

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

ARIZONA

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Clays	184,345	$292,193	178,296	$325,997	189,854	$432,813
Coal	10,060	46,415	4,599	24,178	4,850	23,514
Copper ... Cu content	366,218	153,811,560	375,121	162,802,514	359,010	141,449,940
Fluorspar	1,601	(2)	1,271	(2)	846	(2)
Gold ... troy ounces, Au content	95,860	3,355,100	109,487	3,832,045	108,993	3,814,755
Gypsum (crude)	23,980	128,725	(2)	(2)	(2)	(2)
Lead ... Pb content	28,566	8,227,008	29,899	10,703,842	33,568	10,607,488
Lime (open-market)	54,562	582,074	54,608	763,296	43,529	607,709
Manganese ore (35 percent or more Mn) ... gross weight	133	(2)	240	(2)	223	(2)
Manganiferous ore (5 to 35 percent Mn) ... do	62	(2)	-----	-----	-----	-----
Sand and gravel	1,607,758	1,368,080	2,013,769	1,799,353	1,511,953	970,813
Silver ... troy ounces, Ag content	4,569,084	4,135,021	4,837,740	4,378,309	4,970,736	4,408,767
Stone (except limestone for cement and lime)	353,880	219,891	307,570	263,157	356,050	203,295
Tungsten concentrates ... 60-percent WO_3 basis	13	(2)	23	30,338	(4)	(2)
Zinc ... Zn content	54,644	13,223,848	54,478	14,491,148	70,658	17,523,184
Other minerals: Asbestos, barite, beryllium concentrates (1949), cement (1949), feldspar, gem stones, mica (1947 and 1949), molybdenum concentrates, perlite, pumice (1949), quartz, vanadium concentrates, and minerals indicated by footnote 2	-----	691,199	-----	943,872	-----	963,067
Total Arizona	-----	186,081,000	-----	200,358,000	-----	181,095,000

ARKANSAS

Antimony ore and concentrates........gross weight..	2	$669				
Barite (crude)........	376,017	2,390,643	362,470	$2,899,760	363,352	$2,907,056
Bauxite........long tons, dried equivalent..	1,153,563	6,583,538	1,395,341	8,299,486	1,094,924	6,433,964
Clays (except for cement)........	381,402	876,244	440,803	1,076,372	433,909	1,067,033
Coal........	1,870,949	12,474,871	1,662,187	12,879,396	961,511	7,534,415
Gem stones and industrial diamonds........carats..			(5)	(5)	[5] 246	[5] 1,000
Lead........Pb content..	18	5,184	22	7,876	1	316
Manganese ore (35 percent or more Mn)........gross weight..	841	(2)	212	(2)	2,851	(2)
Manganiferous ore (5 to 35 percent Mn)........do....	2,094	(2)	1,165	(2)	5,555	(2)
Natural gas........thousand cubic feet..	50,680,000	1,818,000	53,946,000	2,422,000	[3] 49,645,000	[3] 2,333,000
Natural-gas liquids:						
Natural gasoline........gallons..	56,787,000	3,668,000	58,285,000	5,454,000	[3] 57,510,000	[3] 3,551,000
LP-gases........do....	37,279,000	1,271,000	36,570,000	2,021,000	[3] 37,962,000	[3] 1,473,000
Petroleum (crude)........barrels, 42 gallons..	20,948,000	54,500,000	31,682,000	78,570,000	[3] 29,936,000	[3] 74,240,000
Sand and gravel........	[6] 2,690,163	[6] 2,267,203	[6] 2,545,104	[6] 2,078,754	[6] 2,507,244	[6] 2,128,474
Stone [7]........	[7] 210,100	[7] 445,650	1,379,410	1,883,500	[7] 1,279,250	[7] 2,247,236
Zinc........Zn content..	18	4,356	31	8,246	1	248
Other minerals: Abrasive stones, cement, gypsum, lime, noncommercial sand and gravel, slate, stone (unclassified 1947 and 1949), and minerals indicated by footnote 2........		4,548,766		4,488,550		5,359,172
Total Arkansas........		90,857,000		122,089,000		109,276,000
Clays sold or used for cement........	21,735	10,868	26,650	19,988	18,094	13,571

Footnotes at end of table, p. 69.

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TAB 'al 'oduction in the United Sta 947–4[illegible] by State Continued

CA FO NIA

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Antimony ore and concentrates....gross weight..			5	$1,467		
Boron minerals....	501,935	$11,844,108	450,932	11,147,735	467,592	$11,511,[illegible]
Calcium-magnesium chloride....75-percent (Ca, Mg) Cl_2 basis..	7,968	111,950	10,009	167,610	11,166	204,[illegible]
Cement....barrels, 376 pounds net..	22,846,458	46,539,749	24,162,926	57,742,226	23,201,982	57,464,[illegible]
Chromite....gross weight..	948	(2)	274	(2)	433	11,[illegible]
Clays (except for cement)....	1,493,570	2,725,282	1,758,256	3,252,017	1,391,088	2,744,[illegible]
Fuller's earth....	(2)	(2)	(2)	(2)		
Coal (lignite)....			1,450	14,500	3,900	39,[illegible]
Copper....Cu content..	2,407	1,010,940	481	208,754	649	255,706
Gold....troy ounces, Au content..	431,415	15,099,525	421,473	14,751,555	417,231	14,603,085
Gypsum (crude)....	811,798	1,996,157	962,038	2,354,390	753,581	1,852,452
Iron ore (usable)....long tons, gross weight..	373,574	(2)	345,863	(2)	584,109	(2)
Lead....Pb content..	10,080	2,903,040	9,110	3,261,380	10,318	3,260,488
Lime (open-market)....	181,296	2,616,599	179,257	3,026,941	153,483	2,510,262
Magnesium compounds from sea water and bitterns (partly estimated) MgO equivalent..	40,000	2,161,000	38,500	2,549,000	27,600	1,770,000
Manganese ore (35 percent or more Mn)....gross weight..					280	(2)
Manganiferous ore (5 to 35 percent Mn)....do....					386	(2)
Mercury....flasks (76 pounds), Hg content..	17,165	1,437,397	11,188	855,770	4,493	357,014
Natural gas....thousand cubic feet..	560,510,000	57,284,000	570,954,000	64,803,000	539,550,000	65,825,000
Natural-gas liquids:						
Natural gasoline and cycle products....gallons..	833,473,000	46,302,000	844,961,000	62,834,000	[3] 862,143,000	[3] 65,827,000
LP-gases....do....	230,635,000	7,901,000	270,103,000	16,527,000	[3] 275,318,000	[3] 19,080,000
Peat....	3,431	22,209	6,942	33,265	5,670	35,193
Petroleum (crude)....barrels, 42 gallons..	333,132,000	572,990,000	340,074,000	822,980,000	[3] 332,839,000	[illegible] 752,220,000
Platinum group (crude)....troy ounces, metals content..	324	(2)	272	(2)	(2)	(2)
Pumice and pumicite....	169,037	1,026,275	196,934	1,110,447	149,878	799,602
Salt (common)....	768,397	3,810,898	914,035	3,927,722	964,807	[illegible],110,271
Sand and gravel....	31,386,826	25,338,967	33,786,520	30,592,965	36,279,816	[illegible],198,924
Silver....troy ounces, Ag content..	1,597,442	1,445,685	724,771	655,954	783,880	709,451
Sodium carbonate (natural)....	293,051	5,862,178	288,769	6,623,280	200,496	[illegible],163,714
Stone [5]....	[5] 12,757,790	[5] 13,012,556	[5] 11,936,240	[5] 13,155,454	11,373,700	2,594,048
Sulfur ore for direct agricultural use....long tons..	698	9,074	(2)	(2)	1,302	26,444
Talc, pyrophyllite, and ground soapstone....	91,537	1,595,422	98,681	1,773,764	83,359	1,434,046
Tungsten concentrates....60-percent WO_3 basis..	394	548,233	1,767	(2)	952	(2)
Zinc....Zn content..	5,415	1,310,430	5,325	1,416,450	7,209	1,787,832

Other minerals: Abrasive stones, asbestos, native asphalt (1947), barite, bromine, carbon dioxide (natural), diatomite, feldspar, gem stones, iodine, lithium minerals, magnesite, mica (1947), molybdenum concentrates, perlite (1948–49), potassium salts, pyrites, quartz, ground sand and sandstone, sodium sulfate, slate, stone (marble 1947, dimension basalt 1948), titanium concentrates (1948–49), and minerals indicated by footnote 2		16,509,285		20,644,200		19,015,094
Total California		843,413,000		1,146,411,000		1,074,416,000
Clays sold or used for cement	456,506	240,078	915,621	561,312	838,631	503,968
Coke	332,244	(9)	296,749	(9)	346,552	(9)
Ferro-alloys	5,278	(9)	(9)	(9)	(9)	(9)
Iron, pig	453,376	(9)	375,113	(9)	494,300	(9)
COLORADO						
Carbon dioxide, natural (estimated) ... thousand cubic feet	23,000	$9,000	16,000	$6,000	8,000	$3,000
Clays (except for cement)	274,596	427,027	298,741	487,598	254,691	490,294
Coal	6,358,104	28,772,028	5,630,786	27,826,179	4,636,432	23,734,510
Copper ... Cu content	2,150	903,000	2,298	997,332	2,403	946,782
Feldspar (crude) ... long tons	43,676	218,593	62,497	253,227	60,966	341,049
Fluorspar	32,153	950,882	27,698	831,218	22,324	763,296
Gold ... troy ounces, Au content	168,279	5,889,765	154,802	5,418,070	102,618	3,591,630
Lead ... Pb content	18,696	5,384,448	25,143	9,001,194	26,853	8,485,548
Manganiferous ore (5 to 35 percent Mn) ... gross weight	37	(2)				
Mica (scrap)	1,341	13,246	5,907	53,358	4,168	60,072
Molybdenum ore and concentrates ... pounds, Mo content	10,783,200	(2)	12,630,400	(2)	10,482,600	(2)
Natural gas ... thousand cubic feet	8,392,000	660,000	8,967,000	539,000	[3] 13,538,000	[3] 839,000
Natural-gas liquids:						
Natural gasoline ... gallons	997,000	68,000	1,200,000	120,000	[3] 6,289,000	[3] 475,000
LP-gases ... do			206,000	12,000	[3] 5,792,000	[3] 300,000
Peat	(2)	(2)	(2)	(2)	2,800	24,504
Petroleum (crude) ... barrels, 42 gallons	15,702,000	29,680,000	17,862,000	45,730,000	[3] 23,934,000	[3] 61,030,000
Pyrites ... long tons	(2)	(2)	(2)	(2)	13,877	50,498
Sand and gravel	3,524,653	2,323,736	4,906,299	2,657,610	4,751,431	2,964,598
Silver ... troy ounces, Ag content	2,557,653	2,314,670	3,011,011	2,725,117	2,894,886	2,620,018
Tin ore and concentrates ... long tons, Sn content					17	87,410
Stone [10]	1,069,250	1,406,989	2,195,250	2,490,449	[10] 1,816,790	[10] 2,803,538
Tungsten concentrates ... 60-percent WO_3 basis	68	108,241	208	337,431	222	(2)
Vanadium ore and concentrates ... pounds, V content	1,912,158	1,110,090	(2)	(2)	(2)	(2)
Zinc ... Zn content	38,745	9,376,290	45,164	12,013,624	47,703	11,830,344
Other minerals: Beryllium concentrates, cement, gem stones, gypsum, lime, lithium minerals (1947), perlite, pumice and pumicite (1947), stone (dimension, unclassified, 1949), sulfur ore, vermiculite (1947 and 1949), and minerals indicated by footnote 2		12,833,255		17,361,861		19,764,722
Total Colorado		102,449,000		128,861,000		141,165,000
Clays sold or used for cement	102,440	51,220	160,074	120,056	214,637	161,000
Coke	871,186	(9)	976,504	(9)	729,516	(9)
Ferro-alloys	11,296	(9)				

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

CONNECTICUT

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	184,751	$184,802	314,569	$230,026	289,090	$216,826
Feldspar (crude) ... long tons	15,408	100,152	12,110	78,772	12,659	95,044
Peat	5,061	25,705	4,332	24,124	5,974	33,011
Quartz from pegmatites and quartzite					16,225	97,350
Sand and gravel	2,829,198	1,384,675	2,576,848	1,487,530	2,648,343	1,587,446
Stone [11]	[11] 1,362,840	[11] 1,929,548	1,525,400	2,283,298	1,695,650	2,460,547
Other minerals		287,987		380,426		390,810
Total Connecticut		3,863,000		4,484,000		4,887,000

DELAWARE

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	(2)	(2)	(2)	(2)	33,212	$46,293
Sand and gravel	235,464	$195,002	(2)	(2)	233,977	196,451
Stone	(2)	(2)	36,390	$89,970	37,240	92,100
Other minerals: Minerals indicated by footnote 2		145,161		312,729		
Total Delaware		340,000		403,000		335,000

FLORIDA

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays (except for cement)	54,576	$507,190	(2)	(2)	95,516	$1,446,544
Fuller's earth	(2)	(2)				
Natural gas ... thousand cubic feet	8,000	258	27,000	$1,000	[3] 40,000	[3] 2,000
Peat	42,300	126,000	24,750	56,171	11,800	69,000
Petroleum (crude) ... barrels, 42 gallons	259,000	(2)	290,000	(2)	[3] 441,000	(2)
Phosphate rock ... long tons	6,482,027	32,920,252	6,539,258	37,732,894	6,815,989	37,857,983
Sand and gravel	2,067,401	1,880,866	2,312,131	2,432,575	2,243,898	1,879,733
Stone [12]	3,534,010	4,511,894	[12] 4,154,920	[12] 5,115,974	4,215,090	4,748,253
Other minerals: Cement, lime, calcareous marl (1949), stone (unclassified, 1948), titanium concentrates, zirconium concentrates, and minerals indicated by footnote 2		5,900,378		8,315,229		8,994,380
Total Florida		45,847,000		53,654,000		54,998,000
Clays sold or used for cement	41,571	20,786	49,386	37,040	80,078	40,039

GEORGIA

Barite (crude)	61,202	$639,865	62,781	$654,959	50,267	$465,325
Clays (except for cement)	1,822,068	13,361,641	2,125,179	15,377,757	1,983,001	16,653,426
Fuller's earth	(2)	(2)	(2)	(2)		
Coal	7,283	39,328	20,000	123,800	16,600	98,360
Gold ... troy ounces, Au content	76	2,660	19	665	18	630
Iron ore (usable) ... long tons, gross weight	295,992	693,485	273,735	746,818	228,689	692,649
Lime (open-market)	10,141	110,983	6,141	58,150	7,028	67,252
Mica (scrap)	1,102	22,985	785	15,683	(2)	(2)
Peat	2,400	48,000	2,500	50,000	1,870	56,000
Sand and gravel	927,330	575,115	985,729	719,771	[6] 984,488	[6] 757,680
Sand and sandstone (ground)	[13] 4,419	[13] 30,971	[13] 1,909	[13] 17,183	771	7,712
Silver ... troy ounces, Ag content	13	12	3	3		
Stone [10]	2,960,520	9,977,938	3,631,430	10,801,355	[10] 4,156,220	[10] 8,427,627
Talc	49,441	673,251	53,602	624,694	49,338	580,405
Other minerals: Asbestos, bauxite, cement, epsom salt from serpentine (1947), feldspar, kyanite (1948–49), mica sheet, sand and gravel (noncommercial, 1949), slate, stone (marble and dimension, unclassified, 1949), and minerals indicated by footnote 2		5,832,559		6,912,481		7,700,505
Total Georgia		32,009,000		36,103,000		35,508,000
Clays sold or used for cement	96,478	74,676	91,486	94,353	75,286	111,242

IDAHO

Antimony ore and concentrates ... gross weight	18,258	$3,193,806	15,941	$4,294,790	4,838	$1,053,177
Clays (except for cement)	24,037	29,320	28,025	27,204	24,850	30,780
Coal					3,219	25,059
Copper ... Cu content	1,640	688,800	1,624	704,816	1,438	566,572
Gold ... troy ounces, Au content	64,982	2,274,370	58,454	2,045,890	77,829	2,724,015
Lead ... Pb content	78,944	22,735,872	88,544	31,698,752	79,299	25,058,484
Mercury ... flasks (76 pounds), Hg content	886	74,194	543	41,534		
Phosphate rock ... long tons	(2)	(2)	431,392	2,094,197	(2)	(2)
Pumice and pumicite	98,618	119,882	79,426	93,602	71,373	105,360
Sand and gravel	3,209,766	2,067,891	3,671,033	2,552,224	3,271,362	2,286,609
Silver ... troy ounces, Ag content	10,345,779	9,362,930	11,448,875	10,361,810	10,049,257	9,095,085
Stone [14]	[14] 1,044,780	[14] 991,599	1,081,060	1,003,858	1,440,680	1,878,801
Tungsten concentrates ... 60-percent WO_3 basis	61	(2)	86	(2)	66	(2)
Zinc ... Zn content	83,069	20,102,698	86,267	22,947,022	76,555	18,985,640
Other minerals: Barite (1949), cement, abrasive garnet, stone (unclassified 1947), vanadium concentrates, and minerals indicated by footnote 2		5,180,456		1,262,545		2,482,678
Total Idaho		66,822,000		79,128,000		64,292,000
Clays sold or used for cement	7,883	3,942	7,831	5,873		

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United State

ILLINOIS

Mineral	1947 Short tons (unless otherwise stated)
Cement ... barrels, 376 pounds net	7,155,280
Clays (including fuller's earth) [14]	2,086,674
Coal	67,860,011
Fluorspar	167,157
Lead ... Pb content	2,325
Lime (open-market)	299,187
Marl, calcareous (except for cement)	(2)
Natural gas ... thousand cubic feet	17,023,000
Natural-gas liquids:	
Natural gasoline ... gallons	47,180,000
LP-gases ... do	115,324,000
Petroleum (crude) ... barrels, 42 gallons	66,459,000
Sand and gravel	16,292,527
Sand and sandstone (ground)	198,500
Silver ... troy ounces, Ag content	1,790
Stone [15]	[16] 15,545,130
Tripoli	14,687
Zinc ... Zn content	10,073
Other minerals: Peat, stone (dimension sandstone, 1947: sandstone, 1948), and minerals indicated by footnote 2	
Total Illinois	
Clays sold or used for cement	148,306
Coke	3,805,374
Iron, pig	5,607,680
Sulfuric acid (from zinc smelting) ... 100-percent basis	173,275

INDIANA

Mineral	1947 Short tons (unless otherwise stated)
Clays (except for cement)	933,739
Coal	25,449,097
Marl, calcareous (except for cement)	27,412
Natural gas ... thousand cubic feet	877,000
Peat	3,957
Petroleum (crude) ... barrels, 42 gallons	6,095,000
Pyrites ... long tons	821
Sand and gravel	9,231,649
Stone [17]	[17] 5,589,550
Other minerals: Abrasive stones, cement, lime, and stone (dimension sandstone, 1947; sandstone, 1948–49)	
Total Indiana	
Clays sold or used for cement	248,139
Coke	8,785,687
Iron, pig	6,385,503

IOWA

Mineral	1947 Short tons (unless otherwise stated)
Cement ... barrels, 376 pounds net	6,155,670
Clays (except for cement)	648,680
Coal	1,684,055
Gypsum (crude)	656,982
Sand and gravel	6,473,087
Stone (except limestone for cement)	5,586,460
Other minerals	
Total Iowa	
Clays sold or used for cement	247,894

Footnotes at end of table, p. 69.

…s, 1947–49, by States—Continued

	1948		1949	
Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
$13, 219, 260	7, 573, 404	$15, 200, 723	7, 976, 972	$16, 645, 730
2, 871, 093	2, 288, 974	3, 300, 167	1, 956, 639	2, 706, 777
213, 834, 014	65, 342, 089	253, 632, 528	47, 207, 959	190, 863, 252
6, 148, 654	172, 561	6, 322, 246	120, 881	4, 621, 733
669, 600	3, 695	1, 322, 810	3, 824	1, 208, 384
2, 736, 262	283, 090	3, 000, 225	276, 161	3, 197, 890
([2])	2, 025	1, 500	----------------	----------------
1, 565, 000	14, 062, 000	1, 735, 000	[3] 18, 354, 000	[3] 2, 349, 000
4, 008, 000	45, 553, 000	5, 575, 000	[3] 39, 157, 000	[3] 2, 753, 000
5, 043, 000	103, 074, 000	7, 851, 000	[3] 97, 379, 000	[3] 4, 655, 000
139, 560, 000	64, 808, 000	179, 520, 000	[3] 64, 583, 000	[3] 178, 900, 000
13, 155, 971	17, 400, 430	15, 101, 915	17, 128, 144	14, 780, 487
1, 614, 173	232, 971	1, 943, 284	217, 577	1, 887, 144
1, 620	4, 047	3, 663	3, 128	2, 831
[16] 18, 160, 506	[16] 18, 533, 290	[16] 22, 823, 138	17, 054, 110	20, 682, 162
271, 115	([2])	([2])	([2])	([2])
2, 437, 666	12, 980	3, 452, 680	18, 157	4, 502, 936
84, 135	----------------	252, 000	----------------	251, 730
425, 380, 000	----------------	521, 038, 000	----------------	450, 008, 000
78, 050	236, 601	171, 677	235, 829	171, 255
49, 267, 806	3, 675, 284	54, 396, 850	3, 195, 645	52, 258, 356
173, 679, 369	5, 503, 437	196, 586, 808	4, 904, 281	204, 467, 609
2, 315, 685	116, 773	1, 649, 285	71, 700	1, 093, 921

$1, 198, 178	962, 561	$1, 095, 164	1, 022, 699	$1, 197, 982
82, 019, 363	23, 849, 257	96, 303, 370	16, 549, 756	66, 988, 237
19, 666	15, 839	17, 031	44, 026	49, 543
80, 000	553, 000	54, 000	[3] 658, 000	[3] 66, 000
14, 760	2, 288	11, 576	7, 949	28, 537
12, 800, 000	6, 974, 000	19, 320, 000	[3] 9, 556, 000	[3] 26, 470, 000
2, 658	470	1, 551	559	1, 873
6, 687, 082	9, 439, 358	7, 091, 922	8, 887, 231	6, 695, 426
[17] 11, 254, 020	[17] 6, 574, 390	[17] 14, 989, 239	[17] 6, 332, 360	[17] 15, 227, 818
19, 786, 202	----------------	23, 066, 193	----------------	23, 950, 991
133, 862, 000	----------------	161, 950, 000	----------------	140, 676, 000
156, 730	247, 464	190, 887	273, 040	203, 812
117, 614, 296	8, 584, 225	125, 355, 310	7, 533, 290	122, 527, 774
195, 211, 140	6, 496, 421	245, 945, 553	6, 028, 173	248, 700, 000

$12, 054, 420	6, 835, 578	$14, 424, 526	6, 655, 208	$14, 602, 554
664, 848	626, 282	663, 327	571, 505	628, 674
6, 428, 832	1, 670, 156	7, 019, 868	1, 724, 484	6, 911, 956
1, 677, 217	729, 880	1, 753, 545	858, 464	2, 188, 002
2, 795, 887	8, 039, 601	3, 729, 488	7, 978, 229	4, 446, 661
7, 385, 436	6, 387, 620	8, 332, 682	6, 831, 190	8, 663, 201
16, 000	----------------	32, 000	----------------	16, 560
31, 023, 000	----------------	35, 955, 000	----------------	37, 458, 000
123, 947	267, 121	138, 383	265, 804	137, 562

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

KANSAS

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement [18] ... barrels, 376 pounds net	[18] 7, 208, 147	[18] $13, 017, 277	[18] 7, 930, 965	[18] $16, 188, 379	[18] 7, 640, 540	[18] $16, 880, 156
Clays (except for cement)	268, 869	243, 226	288, 945	240, 091	302, 208	260, 318
Coal	2, 744, 534	9, 165, 208	2, 538, 040	9, 653, 566	2, 031, 117	7, 968, 140
Lead ... Pb content	7, 285	2, 098, 080	8, 386	3, 002, 188	9, 772	3, 087, 952
Natural gas ... thousand cubic feet	209, 821, 000	10, 598, 000	245, 189, 000	12, 235, 000	[3] 290, 578, 000	[3] 14, 529, 000
Natural-gas liquids:						
Natural gasoline ... gallons	71, 547, 000	3, 827, 000	77, 567, 000	6, 561, 000	[3] 79, 865, 000	[3] 4, 580, 000
LP-gases ... do	27, 648, 000	978, 000	29, 996, 000	1, 716, 000	[3] 32, 430, 000	[3] 1, 119, 000
Petroleum (crude) ... barrels, 42 gallons	105, 132, 000	202, 900, 000	110, 908, 000	288, 360, 000	[3] 101, 868, 000	[3] 262, 820, 000
Salt (common)	904, 898	4, 534, 406	831, 756	4, 960, 828	854, 707	5, 373, 489
Sand and gravel	4, 351, 920	2, 830, 436	5, 083, 083	2, 748, 765	6, 186, 719	3, 327, 920
Stone [19]	4, 792, 850	4, 867, 789	5, 315, 680	5, 481, 190	[19] 5, 978, 420	[19] 7, 951, 490
Zinc ... Zn content	41, 497	10, 042, 274	35, 577	9, 463, 482	29, 433	7, 209, 384
Other minerals: Natural cement, gypsum, pumice and pumicite, and stone (dimension sandstone, 1949)		458, 874		540, 089		502, 347
Total Kansas		265, 061, 000		361, 160, 000		335, 699, 000
Clays sold or used for cement	266, 908	133, 735	298, 490	204, 731	310, 703	213, 981

KENTUCKY

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays (except for cement)	731, 467	$3, 278, 072	748, 138	$3, 482, 487	571, 427	$2, 902, 661
Coal	84, 240, 682	372, 128, 151	82, 083, 939	444, 368, 858	62, 583, 264	315, 472, 327
Fluorspar	90, 256	2, 713, 508	84, 889	2, 663, 377	63, 438	2, 018, 209
Lead ... Pb content	214	61, 632	216	77, 328	187	59, 092
Natural gas ... thousand cubic feet	96, 459, 000	14, 430, 000	70, 095, 000	12, 897, 000	[3] 74, 667, 000	[3] 13, 440, 000
Natural-gas liquids:						
Natural gasoline ... gallons	9, 577, 000	656, 000	10, 025, 000	938, 000	[3] 8, 671, 000	[3] 617, 000
LP-gases ... do	50, 136, 000	1, 304, 000	55, 737, 000	1, 683, 000	[3] 59, 865, 000	[3] 1, 598, 000
Petroleum (crude) ... barrels, 42 gallons	9, 397, 000	19, 830, 000	8, 801, 000	24, 380, 000	[3] 8, 656, 000	[3] 23, 890, 000
Sand and gravel	2, 454, 492	1, 997, 368	2, 066, 993	2, 068, 780	2, 375, 906	2, 168, 626
Stone [14]	[14] 4, 990, 170	[14] 5, 875, 574	6, 154, 950	7, 598, 309	7, 100, 160	8, 586, 402
Zinc ... Zn content	508	122, 936	639	169, 974	935	231, 880
Other minerals: Native asphalt, cement, and stone (dimension limestone, 1947)		3, 703, 379		3, 762, 557		4, 415, 471
Total Kentucky		426, 101, 000		504, 080, 000		375, 400, 000
Clays sold or used for cement	56, 328	28, 164	53, 950	26, 975	52, 954	26, 477
Iron, pig	661, 925	(9)	799, 287	(9)	627, 435	(9)

LOUISIANA

Clays (except for cement)	143,720	$117,766	158,132	$126,902	134,366	$106,841
Natural gas, thousand cubic feet	581,398,000	21,221,000	686,061,000	26,482,000	[3] 733,110,000	[3] 28,591,000
Natural-gas liquids:						
Natural gasoline and cycle products, gallons	481,748,000	26,777,000	527,620,000	46,553,000	[3] 559,236,000	[3] 36,159,000
LP-gases, do	147,097,000	7,090,000	182,218,000	11,346,000	[3] 204,662,000	[3] 6,959,000
Petroleum (crude), barrels, 42 gallons	160,128,000	321,130,000	181,458,000	485,950,000	[3] 190,715,000	[3] 507,310,000
Salt (common)	1,955,382	5,898,828	2,223,249	6,444,751	2,030,076	5,837,714
Sand and gravel [5]	[6] 4,055,834	[6] 4,277,499	[6] 4,319,420	[6] 5,204,046	[6] 5,050,148	[6] 6,107,311
Stone (except limestone for cement)	892,110	827,184	(2)	(2)	(2)	(2)
Sulfur, long tons	862,278	14,658,726	1,005,711	18,100,000	1,111,115	20,000,000
Other minerals: Cement, noncommercial sand and gravel, and minerals indicated by footnote 2		2,780,789		3,990,928		5,173,868
Total Louisiana		404,779,000		604,198,000		616,245,000
Clays sold or used for cement	71,479	35,470	90,738	68,054	115,546	86,660

MAINE

Cement, barrels, 376 pounds net	955,498	$1,970,186	1,176,051	$2,754,568	1,057,413	$2,526,182
Clays (except for cement)	19,845	18,355	26,906	24,552	27,918	24,568
Columbium (niobium) concentrates, pounds, gross weight			100	(2)		
Feldspar (crude), long tons	16,898	97,565	18,774	130,486	18,286	130,275
Mica:						
Scrap	18	460	(2)	(2)	45	1,087
Sheet, pounds	4,393	686				
Peat	2,647	72,875	1,100	29,699	3,312	79,360
Sand and gravel	3,777,147	1,241,377	[6] 496,355	[6] 286,765	4,605,172	1,393,676
Stone [20]	[20] 158,150	[20] 1,557,978	288,760	2,021,035	258,810	2,025,870
Other minerals: Beryllium concentrates, gem stones, lime, lithium minerals (1948), sand and gravel (noncommercial, 1948), slate, stone (unclassified, 1947), and minerals indicated by footnote 2		824,992		2,846,678		561,208
Total Maine		5,784,000		8,094,000		6,742,000
Clays sold or used for cement	1,020	510				

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

MARYLAND

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Clays (except for cement)	537,190	$876,033	520,535	$920,431	586,453	$922,822
Coal	2,051,282	9,836,825	1,661,104	8,733,674	668,332	3,505,099
Lime (open-market)	71,892	673,241	69,032	654,635	64,299	617,696
Sand and gravel	4,624,094	4,792,554	5,833,559	6,158,041	[6] 4,776,815	[6] 6,028,791
Stone [7]	[7] 1,552,610	[7] 2,416,393	1,874,270	3,115,196	[7] 1,789,830	[7] 3,036,410
Other minerals: Cement, feldspar (1947), potassium salts, quartz, noncommercial sand and gravel (1949), slate, stone (crushed, unclassified, 1947; dimension granite, 1949), and talc and ground soapstone		4,696,023		5,420,343		6,350,471
Total Maryland		23,291,000		25,002,000		20,461,000
Clays sold or used for cement	65,444	32,722	69,320	51,997	67,194	50,396
Coke	1,975,201	(9)	2,147,787	(9)	2,039,957	(9)
Iron, pig	2,408,230	(9)	2,805,936	(9)	2,931,596	(9)

MASSACHUSETTS

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Clays	132,109	$110,777	137,069	$112,636	156,017	$135,813
Lime (open-market)	113,420	1,276,693	112,271	1,302,251	107,931	1,360,328
Peat	820	11,000	441	6,188	595	7,415
Quartz from pegmatites and quartzite	1,019	9,185	792	7,288	577	4,265
Sand and gravel	4,942,920	3,511,855	5,500,350	4,418,132	5,504,841	4,379,030
Sand and sandstone (ground)	1,944	11,628	2,150	14,000	1,514	9,650
Stone [21]	[21] 2,505,960	[21] 5,644,821	[21] 2,367,140	[21] 6,592,952	2,290,940	6,552,935
Other minerals		400		130,000		
Total Massachusetts		10,576,000		12,583,000		12,449,000
Coke	1,196,010	(9)	1,056,701	(9)	891,400	(9)
Iron, pig	203,844	(9)	140,575	(9)	125,422	(9)

MICHIGAN

Bromine..........pounds..	18,802,636	$5,054,787	17,666,243	$5,435,940	28,034,765	$7,023,211
Cement..........barrels, 376 pounds net..	10,470,766	18,868,187	11,116,911	23,533,001	12,747,791	28,823,055
Clays (except for cement)..........	375,465	342,750	406,852	372,483	368,578	333,249
Coal..........	14,013	107,667	13,020	90,000	11,450	115,912
Copper..........Cu content..	24,184	10,157,280	27,777	12,055,218	19,506	7,685,364
Gypsum (crude)..........	1,031,157	2,760,825	1,309,331	3,617,868	1,264,511	3,470,294
Iron ore (usable)..........long tons, gross weight..	12,965,482	46,782,975	12,896,478	53,246,591	10,993,239	55,237,126
Magnesium compounds from well brines (partly estimated)...MgO equivalent..	31,700	3,034,000	34,500	3,577,000	23,700	2,719,000
Marl, calcareous (except for cement)..........	4,050	3,000	....	....	1,500	1,500
Natural gas..........thousand cubic feet..	18,812,000	2,386,000	14,981,000	2,195,000	[3] 10,973,000	[3] 1,569,000
Natural-gas liquids:						
Natural gasoline..........gallons..	3,658,000	248,000	2,537,000	246,000	[3] 3,229,000	[3] 216,000
LP-gases..........do..	629,000	17,000	46,000	3,000	....	....
Peat..........	5,013	60,218	12,425	154,500	(2)	(2)
Petroleum (crude)..........barrels, 42 gallons..	16,215,000	34,540,000	16,871,000	48,250,000	[3] 16,495,000	45,360,000
Salt (common)..........	4,447,269	15,043,057	4,387,879	16,265,743	4,064,106	16,009,117
Sand and gravel..........	16,845,431	10,758,243	20,671,078	14,071,712	20,475,996	13,992,903
Silver..........troy ounces, Ag content..	3,089	2,796	....	....	....	....
Stone [13]..........	18,600,370	12,601,288	[13] 19,704,150	[13] 14,620,527	16,546,670	13,387,334
Other minerals: Calcium-magnesium chloride, lime, potassium salts, stone (basalt, 1948), and minerals indicated by footnote 2..........	....	8,866,013	....	5,150,801	....	4,503,892
Total Michigan..........	....	166,634,000	....	202,885,000	....	200,447,000
Clays sold or used for cement..........	807,416	521,715	901,318	613,257	992,572	678,283
Coke..........	2,818,941	32,406,972	2,849,601	39,637,987	2,484,409	34,773,316
Iron, pig..........	1,388,402	(9)	1,534,911	(9)	1,542,206	(9)

MINNESOTA

Clays..........	148,188	$142,806	132,717	$151,965	133,565	$153,446
Gem stones (estimated)..........	(22)	5,000	(22)	5,000	(22)	5,000
Iron ore (usable)..........long tons, gross weight..	62,436,102	203,614,336	67,928,237	249,523,078	55,943,714	239,858,902
Manganiferous ore (5 to 35 percent Mn)..........gross weight..	1,044,961	2,739,340	1,198,523	(2)	990,202	(2)
Marl, calcareous (except for cement)..........	10,100	9,575	11,262	9,209	8,840	7,244
Peat..........	7,000	36,000	3,000	12,900	12,820	54,255
Sand and gravel..........	13,510,136	4,194,268	13,722,541	4,818,983	12,935,392	4,903,908
Stone [20]..........	[20] 1,372,220	[20] 3,854,473	1,804,960	5,090,652	1,878,910	5,278,716
Other minerals: Abrasive stones, cement, lime, stone (basalt, 1947), and minerals indicated by footnote 2..........	....	3,778,447	....	7,636,540	....	7,278,961
Total Minnesota..........	....	218,374,000	....	267,248,000	....	257,540,000
Coke..........	897,739	10,367,425	846,246	12,425,815	781,943	12,693,926
Iron, pig..........	546,432	(9)	557,252	(9)	455,378	(9)

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

MISSISSIPPI

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Clays	383,598	$1,067,584	453,464	$1,416,293	508,425	$1,653,473
Fuller's earth	(2)	(2)	(2)			
Natural gas ... thousand cubic feet	40,037,000	1,989,000	59,899,000	3,336,000	[3] 79,399,000	[3] 4,685,000
Natural-gas liquids:						
Natural gasoline and cycle products ... gallons	16,735,000	915,000	29,044,000	1,815,000	[3] 29,624,000	[3] 2,065,000
LP-gases ... do	3,207,000	159,000	18,133,000	922,000	[3] 20,671,000	[3] 558,000
Petroleum (crude) ... barrels, 42 gallons	34,925,000	61,470,000	45,761,000	110,280,000	[3] 37,966,000	[3] 93,400,000
Sand and gravel	[6] 2,036,136	[6] 1,393,218	2,879,256	1,519,930	[6] 1,942,941	[6] 1,330,413
Stone	(2)	(2)	24,330	27,980	(2)	(2)
Other minerals: Sand and gravel (noncommercial, 1947 and 1949) and minerals indicated by footnote 2		650,581				292,186
Total Mississippi		67,644,000		119,317,000		103,084,000

MISSOURI

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Barite (crude)	291,619	$2,405,249	278,071	$2,413,802	186,891	$1,497,985
Cement ... barrels, 376 pounds net	8,030,939	15,066,390	8,428,343	17,911,257	8,518,636	19,347,814
Clays (except for cement)	1,427,167	3,877,344	1,801,478	5,060,598	1,468,516	3,962,674
Coal	4,236,427	14,093,663	4,022,488	15,688,348	3,047,456	14,919,384
Copper ... Cu content	1,760	739,200	2,870	1,028,580	3,670	1,445,980
Iron ore (usable) ... long tons, gross weight	171,356	(2)	165,326	(2)	144,549	(2)
Lead ... Pb content	132,246	38,086,848	102,288	36,619,104	127,522	40,296,952
Lime (open-market)	889,090	7,006,426	1,009,993	8,998,691	878,501	8,035,117
Natural gas ... thousand cubic feet	38,000	5,000	27,000	5,000	[3] 21,000	[3] 4,000
Petroleum (crude) ... barrels, 42 gallons	55,000	(2)	31,000	(2)	[3] 46,000	(2)
Sand and gravel	[6] 4,597,495	[6] 4,193,474	4,886,611	4,197,922	5,193,672	4,346,681
Silver ... troy ounces, Ag content	93,600	84,708	114,187	103,345	123,413	111,695
Stone [8]	[8] 8,438,320	[8] 11,195,993	[8] 9,020,580	[8] 12,320,220	9,562,720	13,969,008
Tripoli	19,375	469,927	(2)	(2)	15,888	505,851
Tungsten concentrates ... 60-percent WO_3 basis			4	(2)	2	(2)
Zinc ... Zn content	17,074	4,131,908	6,463	1,719,158	5,911	1,465,928
Other minerals: Native asphalt, cobalt (1947), sand and gravel (noncommercial, 1947), ground sand and sandstone, stone (sandstone, 1947–48), and minerals indicated by footnote 2		2,572,211		2,225,435		1,377,431
Total Missouri		103,928,000		108,291,000		111,287,000
Clays sold or used for cement	317,244	173,813	334,074	248,530	351,546	250,911

MONTANA

Clays	67,912	$156,094	55,370	$149,799	53,914	$124,314
Coal:						
Bituminous	3,139,221	6,395,054	2,859,930	6,305,449	2,720,935	6,160,754
Lignite	38,669	112,198	37,660	124,322	45,068	150,785
Copper ... Cu content	57,900	24,318,000	58,252	25,281,368	56,611	22,304,734
Fluorspar			318	(2)	422	(2)
Gold ... troy ounces, Au content	90,124	3,154,340	73,091	2,558,185	52,724	1,845,340
Lead ... Pb content	16,108	4,639,104	18,411	6,591,138	17,996	5,686,736
Manganese ore (35 percent or more Mn) ... gross weight	129,689	4,153,045	130,184	4,362,066	122,382	5,068,425
Manganiferous ore (5 to 35 percent Mn) ... do	3,671	(2)	4,135	(2)	5,517	(2)
Natural gas ... thousand cubic feet	54,282,000	1,560,000	36,551,000	1,696,000	[3] 35,208,000	[3] 1,620,000
Natural-gas liquids:						
Natural gasoline ... gallons	2,768,000	216,000	3,402,000	370,000	[3] 3,601,000	[3] 272,000
LP-gases ... do	2,988,000	208,000	5,045,000	350,000	[3] 6,123,000	[3] 317,000
Petroleum (crude) ... barrels, 42 gallons	8,742,000	16,960,000	9,382,000	24,210,000	[3] 9,149,000	[3] 23,600,000
Phosphate rock ... long tons	236,229	1,571,117	248,683	1,720,254	355,169	2,574,330
Pumice and pumicite	2,035	9,476	(2)	(2)		
Sand and gravel	4,203,797	3,129,921	7,383,873	3,256,957	6,682,144	3,365,472
Silver ... troy ounces, Ag content	6,326,190	5,725,202	6,930,716	6,272,648	6,327,025	5,726,277
Stone [10]	632,620	574,726	614,950	613,024	[10] 602,890	[10] 563,465
Tungsten concentrates ... 60-percent WO_3 basis	4	(2)	[13] 28	(2)	9	(2)
Zinc ... Zn content	46,679	11,054,318	59,095	15,719,270	54,195	13,440,360
Other minerals: Cement, gem stones, gypsum, lime, pyrites, stone (basalt and unclassified, 1949), talc, vermiculite, and minerals indicated by footnote 2		3,798,122		4,260,930		4,936,368
Total Montana		87,735,000		103,841,000		97,756,000

NEBRASKA

Clays (except for cement)	88,859	$80,668	105,384	$98,360	86,593	$85,347
Petroleum (crude) ... barrels, 42 gallons	229,000	420,000	215,000	520,000	[3] 330,000	[3] 730,000
Pumice and pumicite	4,546	43,760	4,000	34,200	4,622	40,000
Sand and gravel	3,792,622	2,135,625	4,725,530	2,933,256	5,114,766	2,911,734
Stone [10]	219,780	537,824	366,110	707,327	[10] 504,870	[10] 840,758
Other minerals		3,486,588		4,092,316		5,493,674
Total Nebraska		6,704,000		8,385,000		10,102,000
Clays sold or used for cement	15,052	7,526	53,595	30,756	46,796	28,777

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

NEVADA

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Antimony ore and concentrates .... gross weight..	1,352	$34,119	225	$52,805	280	$76,964
Barite (crude)	37,388	261,168	(2)	(2)	70,576	416,416
Copper .... Cu content..	49,603	20,833,260	45,242	19,635,028	38,058	14,994,852
Fluorspar	8,042	(2)	9,615	(2)	5,847	(2)
Gold .... troy ounces, Au content..	89,063	3,117,205	111,532	3,903,620	130,399	4,563,965
Gypsum (crude)	526,972	1,377,143	519,552	1,222,070	495,220	1,347,666
Iron ore (usable) .... long tons, gross weight..	5,452	(2)	8,945	(2)	3,094	(2)
Lead .... Pb content..	7,161	2,062,368	9,777	3,500,166	10,626	3,357,816
Manganese ore (35 percent or more Mn) .... gross weight..	67	(2)	----------	----------	----------	----------
Manganiferous ore (5 to 35 percent Mn) .... do..	13,117	(2)	8,707	(2)	4,964	52,990
Mercury .... flask (76 pounds), Hg content..	3,881	324,995	1,206	92,247	4,170	331,348
Sand and gravel	963,253	1,460,251	2,248,885	2,018,151	1,346,608	1,212,166
Silver .... troy ounces, Ag content..	1,377,579	1,246,709	1,790,020	1,620,058	1,800,209	1,629,280
Stone (except limestone for lime)	1,691,700	1,068,840	554,880	680,957	518,510	668,960
Sulfur ore for direct agricultural use .... long tons..	(2)	(2)	358	7,160	860	15,050
Talc and pinite	9,767	175,489	8,019	107,730	8,837	147,148
Tungsten concentrates .... 60-percent WO_3 basis..	2,002	2,673,714	949	(2)	740	(2)
Zinc .... Zn content..	16,970	4,106,740	20,288	5,396,608	20,443	5,069,864
Other minerals: Andalusite, brucite, clays (including fuller's earth), diatomite, dumortierite (1949), gem stones, lime, magnesite, calcareous marl, molybdenum concentrates, perlite (1947 and 1949), pumice (1949), salt, and minerals indicated by footnote 2	----------	2,181,433	----------	4,242,064	----------	3,491,553
Total Nevada	----------	40,923,000	----------	42,479,000	----------	37,376,000

NEW HAMPSHIRE

Mineral	1947		1948		1949	
Clays	28,605	$21,456	25,262	$18,960	26,392	$19,795
Mica (scrap)	403	9,937	(2)	(2)	(2)	(2)
Peat	----------	----------	----------	----------	15	296
Sand and gravel	[23] 1,737,084	[23] 198,748	2,481,658	651,042	[23] 2,000,842	[23] 236,895
Stone	109,230	399,879	88,430	314,353	6,910	381,141
Other minerals: Abrasive stones, beryllium concentrates, feldspar, mica (1949), sand and gravel (commercial, 1947 and 1949), and minerals indicated by footnote 2	----------	623,504	----------	346,888	----------	746,009
Total New Hampshire	----------	1,254,000	----------	1,331,000	----------	1,384,000

NEW JERSEY

Clays (except for cement)	571,283	$1,402,690	599,818	$1,571,034	537,480	$1,314,186
Iron ore (usable) ... long tons, gross weight	468,895	3,689,832	436,372	3,739,985	448,489	4,468,575
Manganiferous residuum	227,547	(2)	291,383	(2)	158,902	(2)
Marl (greensand)	8,337	432,980	7,269	392,959	6,128	276,564
Peat	21,640	135,300	23,102	163,056	25,500	180,750
Sand and gravel [6]	[6] 5,532,011	[6] 6,335,343	[6] 6,325,445	[6] 7,489,662	[6] 5,555,121	[6] 6,981,862
Sand and sandstone (ground)	118,446	772,213	116,832	782,644	107,946	755,215
Stone (except limestone for lime)	3,857,710	6,136,857	3,591,440	6,375,877	4,070,790	7,896,619
Zinc [24] ... Zn content	76,871	17,420,052	76,332	20,709,849	50,984	14,443,062
Other minerals: Lime, magnesium compounds, noncommercial sand and gravel, and minerals indicated by footnote 2		2,107,468		3,163,230		2,266,802
Total New Jersey		38,433,000		44,388,000		38,584,000
Clays sold or used for cement	221	4,611				
Coke	1,432,210	(9)	1,410,941	(9)	1,345,094	(9)

NEW MEXICO

Beryllium concentrates ... gross weight	(2)	(2)			8	(1)
Carbon dioxide, natural (estimated) ... thousand cubic feet	75,000	$30,000	73,000	$29,000	87,000	$35,000
Clays	56,772	50,400	50,459	63,140	97,751	69,002
Coal	1,443,210	6,522,061	1,363,932	6,947,360	1,004,034	5,226,678
Copper ... Cu content	60,205	25,286,100	74,687	32,414,158	55,388	21,822,872
Fluorspar	27,526	841,095	24,968	911,682	12,844	446,086
Gold ... troy ounces, Au content	3,146	110,110	3,414	119,490	3,249	113,715
Lead ... Pb content	6,383	1,838,304	7,653	2,739,774	4,652	1,470,032
Manganese ore (35 percent or more Mn) ... gross weight	558	(2)				
Manganiferous ore (5 to 35 percent Mn) ... do	97,007	(2)	122,870	(2)	65,511	(2)
Natural gas ... thousand cubic feet	142,740,000	2,526,000	194,749,000	5,255,000	[3] 185,016,000	[3] 5,365,000
Natural-gas liquids:						
Natural gasoline ... gallons	92,303,000	6,026,000	100,052,000	9,111,000	[3] 114,407,000	[3] 7,791,000
LP-gases ... do	20,748,000	703,000	30,256,000	1,358,000	[3] 54,315,000	[3] 2,113,000
Petroleum (crude) ... barrels, 42 gallons	40,926,000	72,440,000	47,969,000	117,520,000	[3] 47,932,000	[3] 116,960,000
Potassium salts ... K_2O equivalent	880,605	28,035,675	967,945	29,177,328	932,497	27,950,111
Pumice and pumicite	55,639	512,176	177,630	812,545	351,308	1,026,479
Salt (common)	12,006	19,239	(2)	(2)	(2)	(2)
Sand and gravel	540,794	492,583	[6] 717,058	[6] 573,385	883,223	610,839
Silver ... troy ounces, Ag content	515,533	466,829	537,674	486,622	380,855	344,693
Stone	477,970	251,080	531,300	293,858	138,290	106,135
Tantalum concentrates ... pounds, gross weight	3,259	8,677				
Zinc ... Zn content	44,103	10,672,926	41,502	11,039,532	29,346	7,277,808
Other minerals: Barite (1949), gem stones, gypsum (1948–49), lithium minerals (1947), mica (1948), molybdenum concentrates, perlite (1948–49), sand and gravel (noncommercial, 1948), vanadium concentrates (1947–48), and minerals indicated by footnote 2		715,503		1,219,726		900,116
Total New Mexico		157,548,000		220,075,000		199,629,000

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

NEW YORK

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Cement [18] ... barrels, 376 pounds net	[18] 11,592,821	[18] $21,060,957	[18] 12,299,226	[18] $26,071,417	[18] 12,679,906	[18] $28,483,681
Clays (except for cement)	903,703	720,169	1,161,962	928,266	976,751	769,290
Emery	5,798	66,927	5,405	69,408	4,909	60,917
Gypsum (crude)	949,375	2,613,094	1,228,358	3,294,973	916,117	2,805,154
Iron ore (usable) ... long tons, gross weight	2,513,555	19,673,363	2,932,442	24,384,648	2,344,518	22,184,757
Lead ... Pb content	1,496	430,848	1,231	440,698	1,317	416,172
Marl, calcareous (except for cement)	500	3,000	------	------	550	3,000
Natural gas ... thousand cubic feet	4,600,000	1,118,000	4,705,000	1,040,000	[3] 4,069,000	[3] 977,000
Natural gasoline ... gallons	11,000	1,000	13,000	1,000	[3] 9,000	[3] 1,000
Petroleum (crude) ... barrels, 42 gallons	4,702,000	20,050,000	4,621,000	22,830,000	[3] 4,248,000	[3] 15,120,000
Salt (common)	2,923,023	11,875,485	3,065,831	13,056,542	2,951,750	13,042,322
Sand and gravel	13,820,196	10,906,224	16,369,303	13,382,370	18,543,071	15,116,820
Silver ... troy ounces, Ag content	22,409	20,280	15,758	17,004	18,378	16,633
Slate	141,780	1,575,252	125,520	1,532,880	122,180	1,617,097
Stone (except limestone for cement and lime)	11,197,990	14,992,064	12,687,970	17,261,486	13,022,070	18,160,387
Talc	(2)	(2)	119,716	2,613,935	115,636	2,658,774
Wollastonite	80	1,600	75	1,500	500	7,000
Zinc ... Zn content	34,116	8,256,072	34,566	9,194,556	37,973	9,417,304
Other minerals: Abrasive stones (1947–48), natural cement, feldspar, abrasive garnet, lime, peat (1947), pyrites, titanium concentrates, and minerals indicated by footnote 2	------	8,968,324	------	7,502,136	------	7,408,070
Total New York	------	122,333,000	------	143,623,000	------	138,265,000
Clays sold or used for cement	270,431	135,216	303,323	201,218	308,276	204,918
Coke	5,670,333	58,629,308	5,687,225	72,756,957	5,164,790	69,074,052
Ferro-alloys	346,330	52,912,305	365,067	66,185,597	(9)	(9)
Iron, pig	3,675,217	101,204,575	3,744,341	122,440,520	3,243,800	142,107,633

NORTH CAROLINA

Clays	1,068,572	$1,314,976	1,204,747	$1,436,417	1,181,047	$1,335,954
Coal					13,646	104,392
Feldspar (crude) ... long tons	220,997	1,081,514	201,774	1,116,825	160,916	973,431
Gold ... troy ounces, Au content					18	455
Mica:						
Scrap	38,655	844,086	44,428	992,303	24,801	640,374
Sheet ... pounds	210,816	84,275	257,926	44,678	470,072	121,270
Olivine	7,938	(2)	3,926	(2)	2,458	(2)
Sand and gravel	4,171,553	2,956,800	4,837,437	3,522,403	5,092,929	3,553,180
Stone	5,018,060	7,561,167	5,237,050	7,713,859	6,225,290	10,077,976
Talc and pyrophyllite	97,484	1,186,463	104,052	1,455,691	86,208	1,344,767
Titanium concentrates (ilmenite)	27,199	(2)	28,790	(2)	31,714	(2)
Tungsten concentrates ... 60-percent WO_3 basis	538	(2)	965	(2)	770	(2)
Other minerals: Abrasive stones, asbestos (1947–48), beryllium concentrates (1949), quartz, vermiculite, and minerals indicated by footnote 2		1,356,380		1,949,242		1,602,981
Total North Carolina		16,386,000		18,231,000		19,755,000

NORTH DAKOTA

Coal (lignite)	2,750,862	$5,312,084	2,960,989	$6,729,426	2,967,260	$7,003,712
Natural gas ... thousand cubic feet	442,000	14,000	643,000	19,000	551,000	19,000
Sand and gravel	2,383,021	920,111	5,244,995	1,712,827	4,370,521	1,638,293
Other minerals (nonmetallic)		11,860		16,404		149,181
Total North Dakota		6,258,000		8,478,000		8,810,000

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

OHIO

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement ... barrels, 376 pounds net	9,296,311	$16,611,421	10,020,198	$20,496,930	10,157,001	$22,388,726
Clays (except for cement)	4,229,090	7,546,893	4,525,125	8,023,435	4,043,999	7,447,829
Coal	37,548,204	131,344,763	38,708,278	155,129,035	30,960,537	123,053,152
Lime (open-market)	1,774,847	17,685,220	1,936,211	21,473,401	1,712,248	20,321,387
Natural gas ... thousand cubic feet	68,946,000	18,548,000	65,619,000	12,901,000	[3] 52,955,000	[3] 10,432,000
Natural-gas liquids:						
Natural gasoline ... gallons	6,940,000	499,000	6,087,000	629,000	[3] 5,270,000	[3] 442,000
LP-gases ... do	144,000	5,000	211,000	11,000		
Peat	17,754	143,247	19,207	162,073	20,372	181,117
Petroleum (crude) ... barrels, 42 gallons	3,108,000	10,440,000	3,600,000	15,190,000	[3] 3,433,000	[3] 10,060,000
Salt (common)	2,975,676	6,815,639	2,752,696	5,884,343	2,195,778	5,134,923
Sand and gravel	15,388,990	14,195,288	15,508,815	15,149,848	14,955,657	14,428,820
Stone [7]	[7] 18,710,890	[7] 23,633,433	20,274,570	27,552,017	[7] 19,364,230	[7] 27,419,158
Other minerals: Abrasive stones, calcium-magnesium chloride (1948–49), gypsum, ground sand and sandstone, and stone (unclassified, 1947 and 1949)		1,975,666		2,214,080		2,081,719
Total Ohio		244,444,000		284,816,000		243,391,000
Clays sold or used for cement	333,895	167,436	438,456	234,386	466,132	249,663
Coke	10,069,237	98,973,704	10,562,486	128,843,686	8,911,140	111,443,394
Ferro-alloys	247,035	15,976,882	259,271	21,852,890	195,905	18,725,301
Iron, pig	12,322,330	380,383,106	12,367,227	469,653,906	10,524,132	430,627,906

OKLAHOMA

Clays (except for cement)	223,929	$199,613	254,087	$227,402	244,104	$222,256
Coal	3,420,563	15,101,477	3,462,184	16,618,676	3,021,859	15,242,403
Lead .... Pb content	14,289	4,115,232	16,918	6,056,644	19,858	6,275,128
Natural gas .... thousand cubic feet	419,010,000	16,509,000	480,573,000	23,356,000	[3] 432,516,000	[3] 21,626,000
Natural-gas liquids:						
Natural gasoline .... gallons	280,891,000	18,690,000	272,897,000	26,143,000	[3] 291,000,000	[3] 18,372,000
LP-gases .... do	165,602,000	5,700,000	196,581,000	10,963,000	[3] 238,939,000	[3] 7,909,000
Petroleum (crude) .... barrels, 42 gallons	141,019,000	270,760,000	154,455,000	398,490,000	[3] 151,902,000	[3] 388,870,000
Sand and gravel	1,670,205	1,125,322	2,604,512	1,088,008	2,921,157	1,525,415
Stone (except limestone for cement and lime)	2,610,770	2,679,855	4,027,630	4,141,379	4,341,980	4,027,409
Zinc .... Zn content	51,062	12,357,004	43,821	11,656,386	44,033	10,920,184
Other minerals: Native asphalt, cement, gypsum, lime, pumice and pumicite, salt, and ground sand and sandstone (1949)		7,149,014		8,105,625		8,706,045
Total Oklahoma		354,387,000		506,846,000		483,696,000
Clays sold or used for cement	298,775	149,387	256,229	162,501	236,095	151,923

OREGON

Antimony ore and concentrates .... gross weight	33	$1,338			54	$2,851
Carbon dioxide, natural (estimated) .... thousand cubic feet	(35)	50,000	(35)	$50,000	(35)	50,000
Chromite .... gross weight			3,345	(2)		
Clays (except for cement)	80,789	57,765	110,727	82,506	109,405	89,931
Copper .... Cu content	14	5,880	2	868	20	7,880
Gold .... troy ounces, Au content	18,979	664,265	14,611	511,385	16,226	567,910
Lead .... Pb content	12	3,456	7	2,506	12	3,792
Mercury .... flasks (76 pounds), Hg content	1,185	99,232	1,351	103,338	1,167	92,730
Pumice and pumicite	33,240	111,380	106,277	307,274	104,475	273,427
Sand and gravel	6,020,440	5,541,373	8,384,755	10,628,889	7,134,751	7,682,272
Silver .... troy ounces, Ag content	30,379	27,493	13,596	12,305	12,195	11,037
Stone [10]	3,002,000	4,425,847	3,682,420	5,733,658	[10] 4,397,390	[10] 6,479,164
Tungsten concentrates .... 60-percent WO_3 basis					3	(2)
Zinc .... Zn content	1	242			6	1,488
Other minerals: Asbestos (1949), cement, diatomite, gem stones, lime (1947), perlite, quartz, stone (dimension granite, 1949), and minerals indicated by footnote 2		4,878,873		6,502,544		6,586,865
Total Oregon		15,867,000		28,985,000		21,849,000
Clays sold or used for cement	60,261	30,130	61,441	46,080	54,994	41,246

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

PENNSYLVANIA

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement .... barrels, 376 pounds net	33,655,687	$60,998,207	38,255,543	$81,638,484	36,905,254	$84,839,175
Clays (except for cement)	3,171,507	7,683,270	3,451,351	8,604,429	3,154,680	7,527,012
Coal:						
Anthracite	57,190,009	418,019,486	57,139,948	467,051,800	42,701,724	358,008,451
Bituminous	147,079,296	622,832,802	134,542,257	664,724,161	89,214,603	446,774,181
Cobalt .... pounds, Co content	655,812	(2)	580,703	(2)	678,773	(2)
Gold .... troy ounces, Au content	1,518	53,130	2,200	77,000	1,645	57,575
Iron ore (usable) .... long tons, gross weight	918,088	6,535,016	1,122,220	9,041,450	952,762	9,324,197
Lime (open-market)	1,045,566	9,861,812	1,085,807	11,319,685	911,065	10,190,679
Natural gas .... thousand cubic feet	91,971,000	21,816,000	87,578,000	21,124,000	[3] 85,726,000	[3] 20,574,000
Natural-gas liquids:						
Natural gasoline .... gallons	12,420,000	831,000	11,319,000	1,116,000	[3] 9,566,000	[3] 693,000
LP-gases .... do	593,000	51,000	919,000	67,000	[3] 698,000	[3] 45,000
Peat	(2)	(2)	(2)	(2)	6,663	30,035
Petroleum (crude) .... barrels, 42 gallons	12,690,000	53,170,000	12,667,000	62,830,000	[3] 11,374,000	[3] 40,610,000
Sand and gravel	11,543,971	13,006,644	12,422,546	15,304,020	11,698,939	14,398,577
Silver .... troy ounces, Ag content	9,863	8,926	13,731	12,427	10,827	9,799
Slate	268,240	4,318,196	269,120	5,351,153	228,170	4,578,644
Stone [10]	[10] 22,352,810	[10] 31,938,877	23,172,190	35,189,148	21,226,480	34,855,664
Tripoli (rottenstone)	516	10,380	(2)	(2)	452	9,713
Other minerals: Copper, graphite (1947), mica (1949), potassium salts (1949), pyrites, ground sand and sandstone, ground soapstone (1947), stone (dimension basalt, 1947), and minerals indicated by footnote 2		2,681,775		3,509,081		2,311,584
Total Pennsylvania		1,248,817,000		1,386,960,000		1,034,837,000
Clays sold or used for cement	159,105	174,177	157,676	250,719	156,091	299,667
Coke	22,388,026	222,057,346	22,383,524	257,033,715	14,768,809	179,838,346
Ferro-alloys	564,386	79,956,306	618,677	101,135,580	464,564	84,952,984
Iron, pig	17,587,252	531,716,815	17,750,295	651,136,537	14,893,515	641,033,455
Sulfuric acid (from zinc smelting) .... 100-percent basis	256,347	3,425,877	238,125	3,363,248	229,819	3,506,308

RHODE ISLAND

Sand and gravel	[23] 44,363	[23] $25,261	633,436	$728,990	398,487	$378,896
Stone	[26] 32,090	[26] 400,602	107,080	536,651	[26] 74,670	[26] 451,029
Other minerals (nonmetallic)		359,161		184,042		98,760
Total Rhode Island		785,000		1,450,000		929,000

SOUTH CAROLINA

Clays (except for cement)	708,705	$3,124,510	705,866	$3,712,081	664,333	$3,795,657
Sand and gravel	601,313	278,021	403,285	198,439	[6] 287,108	[6] 145,142
Stone	2,207,840	3,921,465	2,443,750	4,543,436	[27] 2,440,540	[27] 3,625,596
Topaz (industrial)	2,294	45,873	200	4,000	(²)	(²)
Other minerals (nonmetallic)		218,913		426,677		1,456,480
Total South Carolina		7,589,000		8,885,000		9,026,000
Clays sold or used for cement			4,380	2,190	85,197	17,600

SOUTH DAKOTA

Beryllium concentrates ... gross weight	70	$11,762	45	(¹)	69	(²)
Clays (except for cement)	197,450	2,081,659	169,201	$1,714,930	151,341	$1,529,542
Coal (lignite)	14,618	35,727	29,094	86,208	26,429	91,646
Feldspar (crude) ... long tons	55,959	284,378	54,037	270,889	32,272	156,548
Gold ... troy ounces, Au content	407,194	14,251,790	377,850	13,224,750	464,650	16,262,750
Lead ... Pb content	8	2,304	16	5,728	4	1,264
Mica:						
Scrap	1,499	37,225	988	28,515	1,125	31,285
Sheet ... pounds	188,380	28,704			8,367	3,388
Natural gas ... thousand cubic feet	6,000	360	2,000	130	[8] 2,000	[8] 130
Sand and gravel	3,122,409	1,672,253	4,687,055	3,247,428	5,456,742	2,315,430
Silver ... troy ounces, Ag content	111,684	101,074	94,693	85,702	109,383	98,997
Stone [10]	855,650	3,554,096	763,080	3,911,236	[10] 1,023,710	[10] 4,473,432
Tantalum concentrates ... pounds, gross weight			500	(¹)		
Zinc ... Zn content	19	4,598	29	7,714		
Other minerals: Cement, gypsum (1947–48), lime, lithium minerals, quartz (1947–48), stone (crushed granite, 1949), tin (1948), and minerals indicated by footnote 2		1,524,549		1,743,272		1,758,444
Total South Dakota		23,590,000		24,327,000		26,723,000
Clays sold or used for cement	51,413	25,706	57,733	43,300	37,000	28,135

Footnotes at end of table, p. 69.

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Barite (crude)	31,476	$285,853	25,818	$275,242	13,376	$137,120
Cement ....barrels, 376 pounds net	6,101,108	11,017,225	6,774,926	13,667,060	5,992,571	12,857,600
Clays (except for cement)	658,743	2,120,196	700,574	2,501,657	623,774	2,399,837
Fuller's earth	(2)	(2)	(2)	(2)		
Coal	6,258,483	29,840,946	6,483,029	37,232,433	4,172,272	21,804,594
Gold ....troy ounces, Au content	303	10,605	156	5,460	171	5,985
Lead ....Pb content	22	6,336			257	81,212
Lime (open-market)	181,039	1,533,737	163,098	1,442,906	117,053	1,108,139
Manganese ore (35 percent or more Mn) ....gross weight	39	(2)	37	(2)	175	(2)
Natural gas ....thousand cubic feet	80,000	5,000	127,000	12,000	[3] 146,000	[3] 14,000
Petroleum (crude) ....barrels, 42 gallons	8,000	(2)	19,000	(2)	[3] 22,000	(2)
Phosphate rock ....long tons	1,411,848	7,778,619	1,307,507	8,231,251	1,342,252	9,065,588
Sand and gravel	3,891,251	3,805,669	3,816,802	4,147,728	4,056,398	4,054,463
Silver ....troy ounces, Ag content	79,147	71,628	39,692	35,923	41,833	37,861
Stone [10]	6,796,630	10,617,502	8,011,360	12,932,537	[10] 7,613,530	[10] 13,026,948
Zinc ....Zn content	31,212	7,553,304	29,524	7,853,384	29,788	7,387,424
Other minerals: Copper, pyrites, quartz (1947-48), stone (crushed sandstone, 1949), and minerals indicated by footnote 2		5,294,584		5,261,339		5,278,005
Total Tennessee		79,941,000		93,599,000		77,348,000
Clays sold or used for cement	272,598	136,300	294,123	200,900	283,747	203,135
Coke	241,925	(9)	251,428	(9)	213,378	(9)
Ferro-alloys	147,704	9,196,881	144,599	11,072,047	53,756	3,924,274

TEXAS

Abrasive stone: Pebbles, grinding	(2)	(2)	(2)	(2)	226	$2,900
Cement ... barrels, 376 pounds net	12,349,219	$24,111,833	13,786,846	$30,352,972	14,741,805	33,409,347
Clays (including fuller's earth) [28]	1,127,089	2,758,022	1,292,598	3,120,911	1,234,607	3,001,975
Coal (lignite)	60,504	59,293	56,693	58,034	49,473	50,410
Copper ... Cu content	6	2,520	23	9,982	24	9,456
Fluorspar	1,019	(2)	906	(2)	1,770	(2)
Gold ... troy ounces, Au content	45	1,575	57	1,995	40	1,400
Gypsum (crude)	831,633	2,000,341	893,704	2,143,539	843,292	2,178,569
Helium (shipments, calendar years) ... cubic feet	52,822,350	500,576	50,915,346	610,196	51,501,421	688,795
Iron ore (usable) ... long tons, gross weight	289,273	(2)	746,274	(2)	568,722	(2)
Lead ... Pb content	78	22,464	170	60,860	132	41,712
Lime (open-market)	134,530	1,274,095	168,738	1,583,726	173,724	1,739,185
Natural gas ... thousand cubic feet	1,992,704,000	73,331,000	2,289,923,000	103,505,000	[3] 2,601,217,000	[3] 122,257,000
Natural-gas liquids:						
Natural gasoline and cycle products ... gallons	1,654,574,000	109,297,000	1,874,624,000	164,948,000	[3] 1,989,410,000	[3] 123,839,000
LP-gases ... do	984,860,000	32,724,000	1,154,228,000	57,770,000	[3] 1,250,604,000	[3] 47,898,000
Peat	(2)	(2)	1,334	19,028	1,531	12,000
Petroleum (crude) ... barrels, 42 gallons	820,210,000	1,597,630,000	903,498,000	2,357,400,000	[3] 743,990,000	[3] 1,926,940,000
Salt (common)	1,191,621	2,090,098	1,354,109	1,712,169	1,637,388	2,453,803
Sand and gravel	18,198,728	10,540,980	15,137,848	12,810,573	14,997,506	13,467,849
Silver ... troy ounces, Ag content	20,547	18,595	3,065	2,774	2,691	2,435
Stone [12]	3,786,040	4,277,494	[12] 3,844,350	[12] 4,658,720	4,158,430	5,289,647
Sulfur:						
Ore for direct agricultural use ... long tons	2,675	37,450	(2)	(2)	----------	----------
Refined ... do	3,965,825	[13] 70,541,274	3,973,201	71,500,000	3,678,196	66,208,000
Zinc ... Zn content	22	5,324	----------	----------	----------	----------
Other minerals: Native asphalt, bromine, feldspar (1947 and 1949), gem stones, graphite, magnesite (1947 and 1949), magnesium chloride (for metal), magnesium compounds (except for metal), pumice and pumicite, ground sand and sandstone (1948), ground soapstone, sodium sulfate, stone (basalt, 1948), and minerals indicated by footnote 2	----------	14,409,770	----------	18,014,524	----------	16,355,560
Total Texas	----------	1,945,634,000	----------	2,830,283,000	----------	2,365,847,000
Clays sold or used for cement	361,690	180,845	389,956	222,429	495,569	278,174
Coke	263,006	(9)	644,225	(9)	497,019	(9)
Magnesium metal	5,264	(9)	8,489	3,480,496	12,977	5,320,689

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

UTAH

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Asphalt and related bitumens, native:						
Gilsonite	67,165	$1,746,228	52,122	$1,390,713	51,462	$1,303,584
Wurtzilite	17	746				
Carbon dioxide, natural (estimated) thousand cubic feet	183,000	73,000	156,000	62,000	94,000	38,000
Clays (except for cement)	143,284	278,224	131,042	244,664	221,701	624,164
Fuller's earth	(2)	(2)	(2)	(2)		
Coal	7,428,699	29,211,722	6,813,350	31,062,105	6,159,592	29,357,488
Copper Cu content	266,533	111,943,860	227,007	98,521,038	197,245	77,714,530
Fluorspar	1,730	31,592	9,523	195,338	8,332	180,166
Gold troy ounces, Au content	421,662	14,758,170	368,422	12,894,770	314,058	10,992,030
Iron ore (usable) long tons, gross weight	2,821,293	2,860,739	3,233,122	3,926,058	2,698,632	4,403,767
Lead Pb content	49,698	14,313,024	55,950	20,030,100	53,072	16,770,752
Lime (open-market)	47,096	366,127	40,635	352,859	30,082	355,516
Manganiferous ore (5 to 35 percent Mn) gross weight	7,198	(2)	2,694	(2)	4,981	39,983
Natural gas thousand cubic feet	6,040,000	324,000	6,610,000	397,000	[3] 6,329,000	[3] 380,000
Natural gasoline gallons	685,000	47,000	576,000	61,000	[3] 616,000	[3] 47,000
Pumice and pumicite	7,500	30,000	7,618	30,472	(2)	(2)
Petroleum (crude) barrels, 42 gallons			16,000	(2)	[3] 613,000	(2)
Salt (common)	113,285	340,028	113,779	429,494	78,611	386,935
Sand and gravel	2,945,943	1,612,354	2,278,184	1,368,562	2,331,688	1,553,408
Silver troy ounces, Ag content	7,780,032	7,040,929	8,045,329	7,281,429	6,724,880	6,086,356
Stone [10]	[10] 178,680	[10] 368,255	279,660	477,654	283,020	427,418
Tungsten concentrates 60-percent WO_3 basis	1	(2)	3	(2)	1	(2)
Vanadium ore and concentrates pounds, V content	48,949	(2)	(2)	(2)	(2)	(2)
Zinc Zn content	43,673	10,568,866	41,490	11,036,340	40,670	10,086,160
Other minerals: Native asphalt (bituminous sandstone), cement, gem stones, gypsum, molybdenum concentrates, perlite (1948–49), phosphate rock (1947–48), potassium salts, stone (crushed sandstone, 1947), and minerals indicated by footnote 2		10,099,937		14,696,588		17,015,711
Total Utah		206,015,000		204,458,000		177,763,000
Clays sold or used for cement	38,592	19,296	37,008	27,756	29,808	22,356
Coke	1,043,465	(9)	1,247,087	(9)	901,829	(9)

VERMONT

Gold .... troy ounces, Au content	100	$3,500	104	$3,640	120	$4,200
Lime (open-market)	(2)	(2)	22,743	308,004	28,914	356,381
Sand and gravel	780,192	561,862	731,687	619,069	1,581,614	728,394
Silver .... troy ounces, Ag content	21,469	19,429	24,910	22,545	27,446	24,840
Slate	(2)	(2)	192,940	3,631,943	184,040	3,624,230
Stone (except limestone for lime)	392,420	7,652,139	395,380	7,992,144	441,770	8,276,287
Talc	77,327	999,704	70,922	1,014,718	64,508	788,341
Other minerals: Asbestos, clays, copper, and minerals indicated by footnote 2		5,480,308		2,406,628		3,581,645
Total Vermont		14,717,000		15,999,000		17,384,000

VIRGINIA

Clays (except for cement)	374,296	$365,777	444,025	$426,732	449,122	$403,598
Coal	20,170,799	97,405,945	17,999,405	108,094,414	14,584,087	82,366,554
Copper .... Cu content	5	2,100				
Feldspar (crude) .... long tons	41,820	261,741	34,770	231,607	33,936	234,442
Iron ore (usable) .... do	6,782	(2)	2,991	(2)	4,349	(2)
Lead .... Pb content	3,803	1,095,264	4,703	1,683,674	3,313	1,046,908
Lime (open-market)	260,663	2,138,707	382,734	3,271,053	349,132	3,213,897
Manganese ore (35 percent or more Mn) .... gross weight			427	(2)	224	(2)
Manganiferous ore (5 to 35 percent Mn) .... do	6,208	(2)	2,462	(2)	1,270	(2)
Marl, calcareous (except for cement)	98,970	120,995	53,597	65,601	62,482	117,251
Natural gas .... thousand cubic feet	64,000	6,000	74,000	7,000	[3] 83,000	[3] 8,000
Petroleum (crude) .... barrels, 42 gallons	61,000	(2)	33,000	(2)	[3] 43,000	(2)
Sand and gravel	4,570,620	3,852,669	4,098,616	3,837,845	4,412,583	4,049,157
Stone (except limestone for cement and lime)	8,359,420	12,377,061	7,366,520	12,157,241	7,509,740	12,442,765
Zinc .... Zn content	16,788	4,062,696	15,882	4,224,612	13,166	3,265,168
Other minerals: Abrasive stone (millstones), aplite, cement, gypsum, kyanite, mica (1947 and 1949), phosphate rock (1947 and 1949), pyrites, salt, ground sand and sandstone, slate, talc and ground soapstone, titanium concentrates, and minerals indicated by footnote 2		8,607,050		9,333,274		9,262,172
Total Virginia		130,296,000		143,333,000		116,410,000
Clays sold or used for cement	69,075	34,538	74,241	43,625	91,621	51,923
Coke (production)	211,876	2,508,223	200,911	2,886,723		

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

WASHINGTON

Mineral	1947 Short tons (unless otherwise stated)	1947 Value	1948 Short tons (unless otherwise stated)	1948 Value	1949 Short tons (unless otherwise stated)	1949 Value
Abrasive stone:						
Pebbles (grinding)	[2]	[2]	[2]	[2]	20	$240
Pulpstones	76	$4,976	33	$2,100	28	1,975
Antimony ore and concentrates .... gross weight	335	26,091	----	----	14	1,425
Carbon dioxide, natural (estimated) .... thousand cubic feet	[11]	50,000	[11]	50,000	[11]	50,000
Clays (except for cement)	192,422	216,452	234,466	262,260	219,738	267,300
Coal	1,117,926	6,691,202	1,219,903	7,892,123	899,046	6,028,636
Copper .... Cu content	2,240	940,800	5,665	2,458,610	5,275	2,078,350
Gold .... troy ounces, Au content	34,965	1,223,775	70,075	2,452,625	71,994	2,519,790
Iron ore (usable) .... long tons, gross weight	2,268	[2]	5,364	[2]	----	----
Lead .... Pb content	5,359	1,543,392	7,147	2,558,626	6,417	2,027,772
Olivine	2,900	[2]	840	[2]	1,070	[2]
Peat	2,425	10,125	[2]	[2]	[2]	[2]
Pumice and pumicite	26,497	74,173	26,675	47,787	8,610	18,221
Sand and gravel	8,380,571	5,700,960	9,267,225	6,657,129	9,215,914	6,391,412
Sand and sandstone (ground)	[2]	[2]	6,682	33,783	[2]	[2]
Silver .... troy ounces, Ag content	293,736	265,831	375,831	340,146	357,853	323,875
Stone [10]	3,865,110	4,550,275	5,229,500	6,382,462	[10] 3,688,890	[10] 4,105,516
Zinc .... Zn content	13,800	3,339,600	12,638	3,361,708	10,740	2,663,520
Other minerals: Cement, diatomite, epsom salts made from epsomite (1949), gem stones, lime, magnesite, quartz, stone (dimension, unclassified, 1949), talc, and minerals indicated by footnote 2	----	13,413,601	----	16,428,484	----	14,384,537
Total Washington	----	38,051,000	----	48,928,000	----	40,863,000
Aluminum	191,830	53,671,777	232,067	67,411,000	238,812	76,164,000
Clays sold or used for cement	49,752	24,876	56,900	32,292	58,599	34,766

WEST VIRGINIA

Clays (except for cement)	504,169	$1,065,482	538,905	$937,996	477,503	$759,065
Coal	176,156,579	788,825,871	168,861,746	933,606,269	122,610,578	649,696,884
Lime (open-market)	471,914	4,050,950	490,803	4,610,157	350,311	3,535,352
Natural gas ... thousand cubic feet	192,233,000	29,643,000	203,681,000	34,035,000	[3] 184,226,000	[3] 32,424,000
Natural-gas liquids:						
Natural gasoline ... gallons	52,338,000	3,339,000	51,580,000	4,866,000	[3] 45,014,000	[3] 3,153,000
LP-gases ... do	88,935,000	2,975,000	101,173,000	3,675,000	[3] 117,774,000	[3] 3,616,000
Petroleum (crude) ... barrels, 42 gallons	2,617,000	10,210,000	2,692,000	12,810,000	[3] 2,839,000	[3] 8,770,000
Salt (common)	279,300	1,161,429	246,732	1,197,645	355,515	1,288,471
Sand and gravel	3,796,253	5,782,988	3,974,264	6,306,898	[6] 3,284,805	[6] 5,491,274
Stone (except limestone for cement and lime)	4,888,860	6,033,930	4,929,910	5,802,083	4,854,590	6,960,191
Other minerals: Abrasive stones, bromine, calcium-magnesium chloride, cement, calcareous marl, sand and gravel (noncommercial, 1949), and ground sand and sandstone		4,582,824		4,554,640		5,786,036
Total West Virginia		857,670,000		1,012,402,000		721,480,000
Clays sold or used for cement	86,511	51,673	51,574	38,680	77,021	57,766
Coke	3,200,206	28,292,720	3,650,584	37,892,068	3,182,857	34,370,765

Footnotes at end of table, p. 69.

TABLE 5.—Mineral production in the United States, 1947–49, by States—Continued

WISCONSIN

Mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays (except for cement)	81,355	$64,318	83,799	$67,652	80,198	$64,932
Iron ore (usable)...long tons, gross weight	1,543,099	(2)	1,468,953	(2)	1,405,775	(2)
Lead...Pb content	1,166	335,808	861	308,238	857	270,812
Lime (open-market)	70,233	805,000	107,648	1,228,988	107,339	1,254,751
Marl, calcareous (except for cement)	(2)	(2)	10,293	6,991	18,533	10,293
Sand and gravel	16,335,238	9,938,778	18,613,088	11,370,089	17,023,466	10,456,561
Stone [4]	[3] 5,897,960	[3] 11,669,611	[3] 7,224,330	[3] 12,581,046	7,326,710	13,636,020
Zinc...Zn content	12,224	2,958,208	7,864	2,091,824	5,295	1,313,160
Other minerals: Abrasive stones, cement, peat, pyrites (1947–48), quartz, ground sand and sandstone, stone (basalt, 1947–48), and minerals indicated by footnote 2		8,719,537		9,452,740		8,871,417
Total Wisconsin		34,491,000		37,108,000		35,878,000
Clays sold or used for cement	30,095	16,882	71,263	46,151	79,162	51,283

WYOMING

Clays (except for cement)	274,376	$2,592,440	400,636	$3,692,374	369,782	$3,567,044
Coal	8,051,147	27,139,183	6,411,744	23,984,862	6,000,924	22,972,007
Feldspar (crude) long tons	18,801	90,258	16,760	78,080	(2)	(2)
Gem stones (estimated)	(22)	(2)	(22)	(2)	(22)	20,000
Gold troy ounces, Au content	1,486	52,010	115	4,025	389	13,615
Gypsum (crude)	22,643	112,238	(2)	(2)	(2)	(2)
Iron ore (usable) long tons, gross weight	651,471	(2)	689,591	(2)	539,554	(2)
Natural gas thousand cubic feet	45,550,000	2,273,000	52,424,000	3,119,000	[3] 88,005,000	[3] 5,544,000
Natural-gas liquids:						
Natural gasoline gallons	34,817,000	2,759,000	35,874,000	3,813,000	[3] 37,493,000	[3] 2,833,000
LP-gases do	15,993,000	691,000	24,545,000	1,548,000	[3] 15,904,000	[3] 824,000
Petroleum (crude) barrels, 42 gallons	44,772,000	75,220,000	55,032,000	128,230,000	[3] 46,935,000	[3] 107,010,000
Phosphate rock long tons	51,845	290,484	138,946	695,110	(2)	(2)
Sand and gravel	2,268,381	1,490,702	2,021,848	1,507,906	2,352,493	1,912,838
Silver troy ounces, Ag content	95	86	11	10	21	19
Stone (except limestone for cement)	1,393,070	1,497,034	964,460	1,265,694	1,802,580	2,227,096
Sulfur ore for direct agricultural use long tons					3,112	57,322
Other minerals: Cement, sodium carbonate and sulfate, vermiculite (1947–48), and minerals indicated by footnote 2		3,187,596		4,065,984		3,858,407
Total Wyoming		117,395,000		172,004,000		150,839,000
Clays sold or used for cement	122	1,342				

[1] Excludes puzzolan cement, value for which is included with "Other minerals."
[2] Value included with "Other minerals."
[3] Preliminary figure.
[4] Less than ½ ton.
[5] Sales in 1948 included with 1949.
[6] "Commercial." Value of "Noncommercial" included with "Other minerals."
[7] Except limestone for cement and lime and certain stone in 1947 and 1949 included with "Other minerals."
[8] Except limestone for cement and lime and certain stone in 1947–48 included with "Other minerals."
[9] Bureau of Mines not at liberty to publish figure.
[10] Except limestone for cement and lime and certain stone in 1949 included with "Other minerals."
[11] Except limestone for lime and certain stone in 1947 included with "Other minerals."
[12] Except limestone for cement and lime and certain stone in 1948 included with "Other minerals."
[13] Revised figure.
[14] Except limestone for cement and certain stone in 1947 included with "Other minerals."
[15] Except clays sold or used for cement.
[16] Excludes limestone for cement and lime and certain stone in 1947–48 included with "Other minerals."
[17] Except limestone for cement and lime and certain stone included with "Other minerals."
[18] Excludes natural cement, value for which is included with "Other minerals."
[19] Except limestone for cement and certain stone in 1949 included with "Other minerals."
[20] Except limestone for cement and lime and certain stone in 1947 included with "Other minerals."
[21] Except limestone for lime and certain stone in 1947–48 included with "Other minerals."
[22] Weight not recorded.
[23] "Noncommercial." Value of "Commercial" included with "Other minerals."
[24] Value reported for zinc in New Jersey is estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added.
[25] Quantity not available.
[26] Excludes unclassified stone in 1947 and 1949, values for which are included with "Other minerals."
[27] Excludes unclassified stone, value for which is included with "Other minerals."
[28] Except clay sold or used for cement.
[29] Figure not available.

TABLE 6.—Mineral production in Territories of the United States, 1947–49

Territory and mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Alaska:						
Antimony ore and concentrates ... gross weight	40	$16,056	68	$29,336	74	$31,356
Coal	361,220	2,554,797	407,906	2,789,275	433,533	3,309,303
Copper ... Cu content	12	5,040	16	6,944	4	1,576
Gold ... troy ounces, Au content	279,988	9,799,580	248,395	8,693,825	229,416	8,029,560
Lead ... Pb content	264	76,032	329	117,782	51	16,116
Mercury ... flasks (76 pounds), Hg content	127	10,635	100	7,649	100	7,946
Platinum group (crude) ... troy ounces, metals content	13,512	(1)	(1)	(1)	(1)	(1)
Silver ... troy ounces, Ag content	66,150	59,866	67,341	60,947	36,056	32,633
Stone	(1)	(1)	40,730	54,637	(1)	(1)
Tin ore and concentrates ... long tons, Sn content	1	2,200	5	(1)	51	114,800
Tungsten concentrates ... 60-percent WO_3 basis	13	(1)				
Zinc ... Zn content	25	6,050	22	5,852	2	496
Other minerals: Clays (1948), gem stones (1947), pumice (1948), sand and gravel, and minerals indicated by footnote 1		5,957,319		1,257,704		4,005,086
Total Alaska		18,488,000		13,024,000		15,549,000
Hawaii:						
Lime (open-market)	9,130	228,370	8,767	236,799	8,404	226,926
Stone	786,010	1,470,703	837,600	1,917,003	653,890	718,705
Other minerals (nonmetallic)		5,963		16,849		42,826
Total Hawaii		1,705,000		2,171,000		988,000
Total above Territories		20,193,000		15,195,000		16,537,000

[1] Value included with "Other minerals."

TABLE 7.—Mineral production in possessions of the United States, 1947–49

Possession and mineral	1947		1948		1949	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Canal Zone:						
Sand and gravel [1] [2]	45,300	$68,000	54,500	$81,700	39,000	$58,500
Stone (crushed) [1] [2]	101,500	152,200	178,500	267,800	109,200	163,800
Total Canal Zone		220,000		350,000		222,000
Guam: Stone [1] [3]	1,142,000	2,285,000	1,537,000	3,073,000	2,605,000	5,209,000
Puerto Rico:						
Cement ... barrels, 376 pounds net	1,904,125	5,339,381	2,440,455	6,947,027	2,171,486	6,100,041
Lime (open-market)	(4)	(4)	(4)	(4)	7,347	184,618
Salt (common)	13,344	101,287	15,145	112,072	12,664	77,322
Stone	104,470	194,746	[5] 159,350	[5] 311,985	[5] 519,870	[5] 826,621
Other minerals: Clays, sand and gravel, stone (unclassified, 1948–49; and dimension granite, 1949), and minerals indicated by footnote 4		274,267		311,122		167,377
Total Puerto Rico		5,910,000		7,682,000		7,365,000
Trust Territory of the Pacific Islands (Angaur Island): Phosphate rock (exports) long tons	106,194	[6] 426,000	75,501	[6] 380,000	154,568	[6] 747,000
Virgin Islands: [7] Stone (crushed) [1] [2]	(8)	[9] 12,000	8,600	14,000	9,700	16,000
Total above possessions		8,853,000		11,499,000		13,559,000

1 Quantities are estimated short-ton equivalents of cubic yards reported.
2 Data are for fiscal years ended June 30.
3 Distribution by years estimated from reported 1946–49 totals and a partial breakdown.
4 Included with "Other minerals."
5 Excludes certain stone included with "Other minerals."
6 Estimate.
7 St. Croix Island only. Data for St. Thomas Island not available.
8 Figure not available.
9 Conjectural.

TABLE 8.—Value of mineral production in the United States, its Territories and possessions, 1947–49

	1947	1948	1949
States and District of Columbia	$9,609,717,000	$12,273,317,000	$10,554,234,000
Territories	20,193,000	15,195,000	16,537,000
Possessions	8,853,000	11,499,000	13,559,000
Total	9,638,763,000	12,300,011,000	10,584,330,000

Employment and Injuries in the Mineral Industries[1]

By Forrest T. Moyer

GENERAL SUMMARY

EMPLOYMENT in the mineral industries declined 3 percent in 1949 to an average of 717,600 men working daily. Mineral plants were active an average of 207 days, 42 less than in 1948. Owing to the smaller labor force and to the smaller number of days of operation, the total man-hours worked in 1949 declined 20 percent from 1948. The average worker at mineral plants in 1949 had a shift of 7.88 hours, virtually unchanged from 1948. The average hours of work per man-year in the industries was 1,634, or 333 less than in 1948. The lower rate of operating activity in 1949 was noted in each of the major branches of the mineral industries. The greatest reduction in rate of operations was in the coal industry, in which extended work stoppages occurred during 1949. There was only a slight decrease in operating activity in nonmetal mines and quarries; in metal mines, coke ovens, and metallurgical plants the decline was moderate.

The injury record of the mineral industries was improved sharply in 1949. A total of 772 fatal injuries—455 less than in 1948—occurred at a frequency of 0.66 per million man-hours of exposure. This represented a 21-percent improvement over the corresponding rate in 1948 and was the best frequency rate for any year since complete injury data became available in 1930. An estimated total of 53,345 nonfatal injuries occurred in the extractive industries at a frequency rate of 45.50 per million man-hours during 1949. This was a reduction of 25 percent in number of injuries and 7 percent in the frequency of occurrence of nonfatal injuries from corresponding 1948 data. The rate of occurrence of nonfatal injuries in 1949 was lower than that of any year for which injury statistics are available.

There were no major disasters (a single accident in which five or more men are killed) in the mineral industries during 1949. This is the first calendar year in which there were no major disasters since complete fatality statistics on the mineral industries were first available in 1910. In 1948, there were 6 major disasters which caused fatal injuries to 49 men. All of the disasters in 1948 were in bituminous-coal mines.

[1] Data on petroleum, natural-gas, sand and gravel, and clay industries and on iron-smelting and stee industries are excluded from this chapter.

Salient statistics of employment and injury experience in the mineral industries in the United States, 1945–49, by industry groups

	1945	1946	1947	1948	1949 [1]
Average number of men working daily: [2]					
Coal mines	437,921	463,079	490,356	507,333	482,800
Metal mines	61,294	65,234	71,228	71,436	70,300
Nonmetal mines (except stone quarries)	10,371	11,312	12,176	11,950	12,300
Stone quarries	58,180	70,265	75,245	77,344	79,900
Coke plants	22,987	21,410	23,705	25,157	24,600
Metallurgical plants	46,467	44,954	49,082	47,768	47,700
Total	637,220	676,254	721,792	740,988	717,600
Average number of active mine-days: [3]					
Coal mines	259	224	239	227	173
Metal mines	288	249	275	282	255
Nonmetal mines (except stone quarries)	291	291	292	287	276
Stone quarries	264	274	279	284	274
Coke plants	344	337	350	350	320
Metallurgical plants	329	284	313	317	294
Total	271	240	256	249	207
Man-days worked, in thousands: [4]					
Coal mines	113,424	103,847	117,312	115,083	83,664
Metal mines	17,673	16,238	19,567	20,124	17,949
Nonmetal mines (except stone quarries)	3,016	3,297	3,555	3,432	3,392
Stone quarries	15,376	19,262	20,996	21,993	21,895
Coke plants	7,915	7,205	8,293	8,798	7,860
Metallurgical plants	15,268	12,783	15,353	15,121	14,027
Total	172,672	162,632	185,076	184,551	148,787
Man-hours worked, in thousands: [4]					
Coal mines	958,591	879,628	949,540	898,231	650,030
Metal mines	141,295	130,406	157,024	161,516	143,770
Nonmetal mines (except stone quarries)	24,613	26,877	28,809	27,784	27,380
Stone quarries	127,168	158,528	171,979	179,111	176,800
Coke plants	64,375	57,710	66,119	70,021	62,480
Metallurgical plants	121,491	101,673	122,630	121,028	112,040
Total	1,437,533	1,354,822	1,496,101	1,457,691	1,172,500
Number of injuries:					
Fatal:					
Coal mines	1,068	968	1,158	999	593
Metal mines	96	90	126	104	74
Nonmetal mines (except stone quarries)	16	26	12	15	10
Stone quarries	53	55	75	75	65
Coke plants	18	8	15	20	7
Metallurgical plants	19	20	21	14	23
Total	1,270	1,167	1,407	1,227	772
Nonfatal:					
Coal mines	57,117	55,350	57,660	53,472	37,765
Metal mines	6,922	7,345	8,293	7,631	6,640
Nonmetal mines (except stone quarries)	1,145	1,369	1,308	1,176	1,140
Stone quarries	4,121	5,137	5,504	4,994	4,590
Coke plants	835	810	926	917	690
Metallurgical plants	3,271	2,794	3,228	2,749	2,520
Total	73,411	72,805	76,919	70,939	53,345
Injury rates per million man-hours:					
Fatal:					
Coal mines	1.11	1.10	1.22	1.11	0.91
Metal mines	.68	.69	.80	.64	.51
Nonmetal mines (except stone quarries)	.65	.97	.42	.54	.37
Stone quarries	.42	.35	.44	.42	.37
Coke plants	.28	.14	.23	.29	.11
Metallurgical plants	.16	.20	.17	.12	.21
Total	.88	.86	.94	.84	.66
Nonfatal:					
Coal mines	59.58	62.92	60.72	59.53	58.10
Metal mines	48.99	56.32	52.81	47.25	46.18
Nonmetal mines (except stone quarries)	46.52	50.94	45.40	42.33	41.64
Stone quarries	32.41	32.40	32.00	27.88	25.96
Coke plants	12.97	14.04	14.01	13.10	11.04
Metallurgical plants	26.92	27.48	26.32	22.71	22.49
Total	51.07	53.74	51.41	48.67	45.50

[1] [illegible]

[2] Average number of men at work each day mine was active. Because absenteeism and labor turn-over are taken into consideration, this number is lower than number of men available for work as measured by a count of names on payroll.

[3] Average in which operating time of each mine is weighted by average number of workers in mine.

[4] Totals of man-days and man-hours are additions of the rounded subtotals and may differ slightly from totals obtained before rounding.

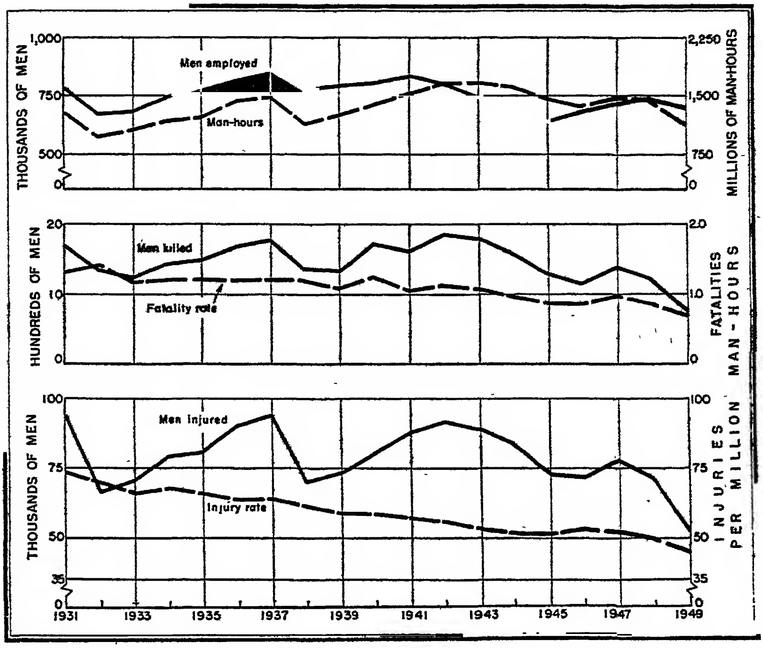

FIGURE 1.—Trends in employment and injury experience in the mineral industries of the United States, 1931–49.

Fatality experience was improved sharply in each of the major branches of the mineral industries except in metallurgical plants. Not only was there a sharp improvement in the rates, but also the number of fatal injuries was reduced appreciably. However, at metallurgical plants, the number of fatal injuries increased to 23 in 1949, and the fatality rate was 75 percent higher than in 1948.

The nonfatal injury record was better than in 1948 in all major branches in mineral industries. The sharpest improvement was at coke plants where the frequency rate of nonfatal injuries was 16 percent better than in 1948. The over-all improvement was achieved through a reduction in the number of nonfatal injuries which more than offset the shorter time of exposure to hazards in 1949.

Work Stoppages.—As in 1948, the mineral industries in 1949 were affected by work stoppages to a greater extent than any other segment of the national economy, because of the prolonged labor-management disputes in the coal industry. The total of 19,887,200 man-days of idleness from work stoppages in the mineral industries represented nearly 40 percent of the total man-days lost because of stoppages in all industries in the country, according to the United States Department of Labor. The total man-days of idleness in the mineral industries during 1949 was nearly double the corresponding figure for 1948.

There were 502 work stoppages in the mineral industries during 1949. Of these, 421 strikes causing a loss of 16,700,000 man-days were at bituminous-coal mines, 34 with a loss of 1,400,000 man-days were at anthracite mines, 17 with a loss of 166,000 man-days were in non-

metal mines and quarries, 9 with a loss of 970,000 man-days were at metal mines, and 9 with a loss of 544,000 man-days were at primary nonferrous smelters and refineries. The 3 stoppages at cement mills, 6 at petroleum refineries and 3 at coke plants had an aggregate loss of 107,000 man-days of work.

The coal industry was plagued with a number of work stoppages, beginning with a "memorial period" of 2-weeks duration that started on March 14 and closed bituminous-coal and anthracite mines east of the Mississippi River. This stoppage was called by the United Mine Workers as a period in memory of the miners killed or injured during 1948 and as a protest to the appointment made to the directorship of the Federal Bureau of Mines. The next major work stoppage affected the entire industry. It was called by the union on June 13 as a "brief stabilizing period of inaction." The men resumed work after 1 week. Following the coal miners' annual vacation (June 25 to July 4), the men in soft-coal mines east of the Mississippi River went on a "3-day workweek" under which the mines were operated Monday, Tuesday, and Wednesday of each week. In mines west of the Mississippi River and in anthracite mines in Pennsylvania, the men resumed the customary 5-day week following their vacation period. On September 19, the United Mine Workers struck all bituminous-coal and anthracite mines over a controversy on the health and welfare program of the union. After 2 weeks, on October 3, bituminous-coal mines west of the Mississippi River and anthracite mines in Pennsylvania were reopened for full production. Soft-coal mines east of the Mississippi River remained closed until November 10, when full production was resumed. Bituminous-coal mines east of the Mississippi were closed again on December 1 and 2, but work was resumed on December 5 with the announcement that the 3-day workweek was again to be effective in all soft- and hard-coal mines. In announcing the short workweek for December, the union stated that mines that signed contracts with them could operate the full week. At the end of December, the union announced that mines with an aggregate annual production of 10 million tons of coal had signed wage agreements that raised payments to the health and welfare fund program from 20 to 35 cents per ton and provided for an increase of 95 cents in daily wages.

Average Earnings.—Average hourly earnings increased in each of the mineral industries for which data are published by the Bureau of Labor Statistics, as shown in the accompanying table. However, due to the lessened number of active days in 1949, the average weekly earnings fell appreciably in anthracite and bituminous-coal mining. There also was a slight decrease in average weekly earnings at copper mines. In all other mineral industries, the average weekly earnings in 1949 were higher than in 1948.

Labor Turn-Over.—Labor turn-over in the mineral industries for which data are published by the Bureau of Labor Statistics was highest in metal mining and lowest in petroleum refining. It is notable

that separation rates of labor turn-over were higher than the accession rates in 1949 in each of the mineral industries, whereas in 1948 the accession rates were higher than the separation rates in each industry except anthracite mining.

Work stoppages, average earnings, and labor turn-over in certain mineral industries in the United States, 1947–49

[Bureau of Labor Statistics]

Industry and year	Work stoppages [1]		Average earnings [2]		Labor turn-over rates [3]	
	Number	Man-days lost (thousands)	Weekly	Hourly	Accession	Separation
Coal mining:						
Anthracite:						
1947	28	159	$62.77	$1.665	1.7	2.0
1948	26	274	66.57	1.809	1.7	1.9
1949	34	1,400	56.78	1.880	1.5	2.1
Bituminous:						
1947	[4] 416	[4] 3,915	66.59	1.636	3.6	3.2
1948	561	9,560	72.12	1.898	3.3	3.1
1949	421	16,700	63.28	1.941	2.0	2.9
Metal mining:						
Total:						
1947	9	62	54.63	1.307	6.0	5.5
1948	11	473	60.80	1.434	4.7	4.5
1949	9	970	61.55	1.505	3.8	4.5
Iron:						
1947	(5)	(5)	52.34	1.302	3.7	3.0
1948	(5)	(5)	58.32	1.412	3.1	2.9
1949	(5)	(5)	59.06	1.484	2.1	2.2
Copper:						
1947	(5)	(5)	59.27	1.323	7.3	6.6
1948	(5)	(5)	65.81	1.456	5.9	5.5
1949	(5)	(5)	63.96	1.512	4.8	5.3
Lead-zinc:						
1947	(5)	(5)	55.09	1.334	6.5	6.7
1948	(5)	(5)	61.37	1.486	6.4	6.0
1949	(5)	(5)	64.79	1.565	3.9	5.5
Nonmetal mining and quarrying:						
1947	24	25	50.54	1.123	(5)	(5)
1948	16	57	55.31	1.243	(5)	(5)
1949	17	166	56.38	1.302	(5)	(5)
Cement:						
1947	2	117	49.56	1.180	4.5	4.1
1948	4	37	54.76	1.307	3.7	3.4
1949	3	37	57.49	1.382	1.7	1.8
Coke and byproducts:						
1947	(5)	(5)	52.17	1.324	(5)	(5)
1948	3	11	58.56	1.475	(5)	(5)
1949	3	31	61.07	1.554	(5)	(5)
Petroleum refining:						
1947	8	283	62.95	1.566	1.6	1.2
1948	6	728	72.06	1.788	1.1	.9
1949	6	39	75.33	1.874	.4	1.0

[1] Number of stoppages beginning during each year and man-days of work lost from only these stoppages during the year.
[2] Monthly averages for production and related workers only; cover both full- and part-time employees who worked during, or received pay for, the pay period ended nearest the 15th of the month.
[3] Monthly averages expressed as the number per 100 employees. Accessions are all additions to the work force, whether new or rehired employees; separations are all terminations of employment including quits, discharges, layoffs, and miscellaneous separations.
[4] Includes data on work stoppages following Centralia mine disaster.
[5] Figure not available.

Employment and injury experience of the mineral industries of the United States, 1931–49

Year	Men working daily	Average active days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-fatal	Fatal	Non-fatal
1931	784,347	188	147,602,799	1,288,135,808	1,707	94,021	1.33	72.99
1932	671,343	165	110,655,616	962,924,915	1,368	66,028	1.42	68.57
1933	677,722	181	122,787,658	1,058,245,650	1,242	70,158	1.17	66.30
1934	739,817	195	144,566,133	1,167,723,543	1,429	79,211	1.22	67.83
1935	783,139	195	152,354,170	1,215,316,764	1,495	80,070	1.23	65.88
1936	824,514	216	177,920,334	1,426,233,543	1,686	90,608	1.18	63.53
1937	859,951	217	186,790,283	1,482,241,908	1,759	94,466	1.19	63.73
1938	774,894	187	145,056,875	1,144,137,296	1,369	69,940	1.20	61.13
1939	788,925	202	159,388,490	1,251,169,210	1,334	73,253	1.07	58.55
1940	801,926	219	175,663,792	1,385,128,234	1,716	80,856	1.24	58.37
1941	835,095	234	195,425,228	1,541,335,277	1,621	87,911	1.05	57.04
1942	802,640	260	208,739,906	1,653,284,620	1,862	91,675	1.13	55.45
1943	747,486	277	207,350,643	1,668,340,394	1,799	88,449	1.08	53.02
1944	676,938	287	194,512,359	1,618,479,042	1,571	83,451	.97	51.56
1945	637,220	271	172,672,431	1,437,533,530	1,270	73,411	.88	51.07
1946	676,254	240	162,630,674	1,354,822,190	1,167	72,805	.86	53.74
1947	721,792	256	185,076,018	1,496,101,097	1,407	76,919	.94	51.41
1948	740,988	249	184,551,937	1,457,690,518	1,227	70,939	.84	48.67
1949 (prelim.)	717,600	207	148,787,000	1,172,500,000	772	53,345	.66	45.50

NATIONAL SAFETY COMPETITION

Mineral operations competing in the twenty-fifth annual National Safety Competition, conducted by the Bureau of Mines, compiled an outstanding safety record during 1949. The over-all injury experience at the record total of 646 enrolled mineral plants was a severity rate of 5.56 days of disability per 1,000 man-hours of work and a frequency rate of 33.21 per million man-hours. The injury-severity rate was lower by a substantial margin than in any other year in the history of the competition. The injury-frequency rate was the second lowest in the 25 years of the competition and was only slightly above the record low rate achieved in 1940. Of the enrolled mines and quarries, 202 operations had no disabling injuries during 1949. The aggregate worktime at these injury-free plants was nearly 16 million man-hours. Trophy awards for the best safety records in each of the six groups of the 1949 competition were made to the following:

Anthracite Underground Mines.—Stevens Shaft mine, Kehoe-Berge Coal Co., Exeter, Pa.

Bituminous-Coal Underground Mines.—Reliance No. 7 mine, Union Pacific Coal Co., Reliance, Wyo.

Metal Underground Mines.—No. 2 mine, American Zinc Co. of Tennessee, Mascot, Tenn.

Nonmetal Underground Mines.—Bellefonte mine, National Gypsum Co., Bellefonte, Pa.

Open-Pit Mines.—Embarrass mine, Pickands Mather & Co. (Lake Mining Co.), Biwabik, Minn.

Quarries.—Dolonah quarry, Tennessee Coal, Iron & Railroad Co., Bessemer, Ala.

COAL MINES

The safety record of coal mines in the United States during 1949 was improved over 1948 and was better than in any year since 1930, when complete injury statistics were first compiled. The tentative frequency rate—59.01 injuries (fatal and nonfatal) per million man-hours—was a decrease of 3 percent from 1948. The previous record low rate for the coal industry was 60.26 injuries per million man-hours in 1944. Both the bituminous-coal and anthracite industries contributed to the record in 1949, and the frequency per million man-hours of both fatal and nonfatal injuries in each industry fell to record low rates.

Based upon the estimated output of 477,700,000 tons of anthracite and bituminous coal, the fatal rate per million tons was improved to 1.24 in 1949, the lowest annual rate in a statistical history extending back to 1910. The nonfatal injury rate per million tons, likewise, was improved appreciably to 79.06 in 1949.

The 593 fatal injuries in 1949 were 406 fewer in number than in 1948 and represented the lowest annual total since complete fatality statistics were first compiled. No major disasters (a single accident in which five or more men are killed) occurred in 1949 in either bituminous-coal or anthracite mines. This is the first calendar year the entire coal industry has operated without a major disaster since complete fatality records became available in 1910. The number of nonfatal injuries during 1949 is estimated to be 37,765, or 29 percent less than in 1948.

The average number of men working daily in coal mines declined 5 percent to a total of 482,800 men in 1949. Due to extended work stoppages and a 3-day workweek during part of 1949, the mines were active an average of 173 days, a reduction of 54 days from 1948. As a result, the aggregate hours of work in coal mines declined 28 percent from 1948. The average miner during 1949 worked a 7.77-hour shift and accumulated a total of 1,346 hours of work, 424 hours less than in 1948.

Bituminous-Coal Mines.—The safety record of the bituminous-coal industry during 1949 was better than in any year since 1930, when complete injury data were first available. The tentative rate of 55.58 injuries (fatal and nonfatal) per million man-hours was 3 percent below the rate of 57.43 in 1948 and also was lower than the previous low record of 57.25 injuries per million man-hours in 1944. The estimate of 500 fatalities in bituminous-coal mines was 362 fewer than in 1948 and was lower than in any other year in the statistical history of the industry. The fatality rate of 0.92 was the best on record, and for the first time since such rates were compiled in 1930 it was less than one per million man-hours of exposure. The 1949 fatality rate represented a 20-percent improvement over 1948. The more favorable fatality experience in bituminous-coal mines also is shown by the rate of 1.15 fatal injuries per million tons, which set a new low annual record for the industry. It is notable that 1949 was the first calendar year in which the industry

was free of a major disaster. In 1948 there were 6 major disasters which resulted in the death of 49 men in soft-coal mines. The estimated total of 29,585 nonfatal injuries was 30 percent lower than in 1948. The frequency rate for these nonfatal injuries was 3 percent better than in 1948 and was lower than in any year since 1930 when the data were first compiled. The frequency of occurrence of nonfatal injuries per million tons of coal mined also was improved in 1949 to a rate of 68.01.

Employment and injury experience at coal mines in the United States, 1945–49

Industry and year	Men working daily	Average active mine-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Bituminous-coal mines:[1]								
1945	364,997	257	93,854,353	817,316,198	925	46,194	1.13	56.52
1946	385,142	215	82,849,738	727,994,944	795	42,817	1.09	58.81
1947	411,845	236	97,105,260	803,016,338	985	46,025	1.23	57.32
1948	429,378	220	94,574,820	747,685,733	862	42,078	1.15	56.28
1949 (preliminary)	404,800	169	68,604,000	541,230,000	500	29,585	.92	54.66
Pennsylvania anthracite mines:								
1945	72,924	268	19,569,421	141,274,969	143	10,923	1.01	77.32
1946	77,937	269	20,997,263	151,633,250	173	12,533	1.14	82.65
1947	78,511	257	20,206,753	146,523,360	173	11,635	1.18	79.41
1948	77,955	263	20,508,227	150,544,988	137	11,394	.91	75.69
1949 (preliminary)	78,000	193	15,060,000	108,800,000	93	8,180	.85	75.18
Total coal mines:								
1945	437,921	259	113,423,774	958,591,167	1,068	57,117	1.11	59.58
1946	463,079	224	103,847,001	879,628,194	968	55,350	1.10	62.92
1947	490,356	239	117,312,013	949,539,698	1,158	57,660	1.22	60.72
1948	507,333	227	115,083,047	898,230,721	999	53,472	1.11	59.53
1949 (preliminary)	482,800	173	83,664,000	650,030,000	593	37,765	.91	58.10

[1] Includes lignite.

Of total fatalities at bituminous-coal mines, 441 occurred in underground workings, 43 at surface works associated with deep mines, and 16 at stripping operations. The total of 441 killed in underground workings was 42 percent lower than the 761 in 1948. All major causes of underground fatal injuries showed a lower number of deaths during 1949 than in 1948. The hazard of falls of roof and face was controlled more effectively in 1949, and the total of 283 fatalities from this cause was 192 less than in 1948. Underground haulage accidents killed 104 men in 1949, likewise a marked reduction from 1948. Fatal injuries in gas and dust explosions were reduced to an all-time low of three in 1949; the three fatalities resulted from one local explosion.

Employment at bituminous-coal mines declined 6 percent to an average of 404,800 men working daily during 1949. Due to strikes and 3-day workweeks, the mines were active an average of only 169 days or 51 less than in 1948. Total man-hours worked in soft-coal mines fell 28 percent from 1948. The average worker had a 7.89-hour shift, and the average work year per man was 1,337 hours, a reduction of 404 hours from 1948.

Anthracite Mines.—Injury experience in Pennsylvania anthracite mines was improved over 1948 and was better than in any year since

complete injury data were first available in 1930. The tentative frequency rate (fatal and nonfatal) was 76.03 per million man-hours. An estimated total of 93 fatalities occurred in anthracite mines in 1949, a reduction of 44 from 1948. For the second successive year there was no major disaster in the anthracite mines. The fatality rate per million man-hours was reduced 7 percent from 0.92 in 1948 to 0.85 in 1949. This was the best frequency rate of fatal injuries in the accident-statistical history of the industry and marked the second consecutive year in which this rate was lower than one fatal injury per million man-hours. Based upon an estimated production of 42,700,000 tons of clean coal, the frequency of 2.18 fatal injuries per million tons in 1949 also was the lowest on record for the industry. A total of 8,180 nonfatal injuries occurred at rates of 75.18 per million man-hours of exposure and 191.57 per million tons of coal produced—both improvements over corresponding data for 1948.

At anthracite operations, 85 fatal injuries occurred in underground workings, 7 at surface works associated with deep mines, and 1 in stripping operations. There was a marked reduction in the number of fatal injuries from falls of roof and face, which killed 55 men in 1949. The number of fatal injuries in underground workings was reduced also for explosives, electricity, machinery, and miscellaneous causes. However, fatalities from haulage accidents, explosions, and shaft accidents were higher in 1949 than in 1948. Three local explosions in 1949 killed five men, whereas two men were killed in a local explosion in 1948. At strip operations, the reduction in fatal injuries from nine in 1948 to one in 1949 is a notable safety achievement.

The average number of men working daily in anthracite mines during 1949 was virtually unchanged from 1948. Due principally to work stoppages and the 3-day workweek, the mines were active an average of 193 days, or 70 less than in 1948. Aggregate worktime in the industry declined 28 percent to a total of 108,800,000 hours in 1949. The average shift was 7.22 hours in 1949, and the average employee worked a total of 1,395 hours, 536 less than in 1948.

METAL MINES

The over-all injury record at metal mines during 1949 improved. A total of 74 fatal injuries, or 30 less than in 1948, occurred at a rate of 0.51 per million man-hours, a reduction of 20 percent. Fatal experience was better in each group of mines except at lead-zinc mines, where the fatality frequency rate increased sharply over 1948. For the third successive year, the nonfatal-injury frequency rate at metal mines was reduced; the rate for 1949 was 46.18 per million man-hours. The improvement in 1949 resulted from more favorable frequency rates in iron, copper, and lead-zinc mines, which more than offset the less favorable rates in the other metal-mine groups.

Employment decreased slightly to an average of 70,300 men working daily. Employment was lower during 1949 for each group of metal mines except iron mines, where there was a slight increase. The aggregate time worked at metal mines declined 11 percent from 1948 to a total of 143,770,000 man-hours. This decline resulted largely from the smaller number of active mine days, which in 1949 averaged 255, or 27 less than in 1948. Work stoppages caused part of this reduction

in active days, particularly at iron mines, which were closed during the "steel" strike through October and the early part of November. The average length of shift for all metal mines was 8.01 hours, and the average employee worked 2,045 hours during 1949, a reduction of 216 hours from 1948.

Employment and injury experience at metal mines in the United States, 1945–49, by industry groups

Industry and year	Men working daily	Average active mine-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Iron mines:								
1945	23,443	286	6,696,157	53,781,487	36	1,326	0.67	24.66
1946	24,723	227	5,603,762	45,048,416	25	1,206	.55	26.77
1947	26,478	273	7,238,851	58,157,587	36	1,403	.62	24.12
1948	27,116	287	7,786,361	62,468,142	34	1,440	.54	23.05
1949 (preliminary)	27,500	247	6,783,000	54,380,000	22	1,135	.40	20.87
Copper mines:								
1945	14,542	305	4,434,654	35,474,475	23	1,531	.65	43.16
1946	12,969	276	3,578,349	28,622,003	23	1,457	.80	50.90
1947	15,654	305	4,782,153	38,263,818	32	1,655	.84	43.25
1948	16,280	305	4,959,483	39,684,197	31	1,572	.78	39.61
1949 (preliminary)	15,800	273	4,312,000	34,490,000	12	1,130	.35	32.76
Lead-zinc mines:								
1945	14,645	292	4,273,405	34,161,578	29	2,976	.85	87.12
1946	15,934	265	4,228,143	33,777,747	30	2,916	.89	86.33
1947	16,628	268	4,457,549	35,618,006	33	3,221	.93	90.43
1948	16,113	264	4,255,190	34,034,255	22	3,050	.65	89.62
1949 (preliminary)	15,900	252	3,999,000	31,950,000	28	2,800	.88	87.64
Gold-silver mines:								
1945	3,816	289	1,104,543	8,407,743	4	533	.48	63.39
1946	5,152	253	1,305,504	10,203,525	8	1,000	.78	98.01
1947	5,537	255	1,414,106	11,063,328	14	1,192	1.27	107.74
1948	5,276	273	1,442,554	11,328,421	13	986	1.15	87.04
1949 (preliminary)	4,800	280	1,344,000	10,400,000	10	965	.96	92.79
Gold placers:								
1945	1,819	175	318,102	2,683,598	-------	64	-------	23.85
1946	3,458	212	732,683	6,438,965	1	220	.16	34.17
1947	3,920	212	830,710	7,166,257	3	230	.42	32.09
1948	3,772	230	867,709	7,423,065	1	180	.13	24.25
1949 (preliminary)	3,500	221	775,000	6,670,000	-------	190	-------	28.49
Miscellaneous:[1]								
1945	3,029	279	845,950	6,786,457	4	492	.59	72.50
1946	2,998	263	789,562	6,315,410	3	546	.48	86.46
1947	3,011	280	843,616	6,755,376	8	592	1.18	87.63
1948	2,879	282	813,035	6,578,055	3	403	.46	61.26
1949 (preliminary)	2,800	263	736,000	5,880,000	2	420	.34	71.43
Total:								
1945	61,294	288	17,672,811	141,295,338	96	6,922	.68	48.99
1946	65,234	249	16,238,003	130,406,066	90	7,345	.69	56.32
1947	71,228	275	19,566,985	157,024,372	126	8,293	.80	52.81
1948	71,436	282	20,124,332	161,516,135	104	7,631	.64	47.25
1949 (preliminary)	70,300	255	17,949,000	143,770,000	74	6,640	.51	46.18

[1] Includes antimony, bauxite, chromite, cobalt, manganese, mercury, molybdenum, pyrite, titanium, tungsten, and vanadium-uranium mines.

Iron Mines.—Injury experience at iron mines was appreciably better than in 1948. The frequency rate for the 22 fatal injuries in 1949 was 0.40, or 26 percent below 1948. The frequency rate for nonfatal injuries was improved by 9 percent to a rate of 20.87 per million man-hours in 1949. Employment increased slightly; but, as the mines were active 40 fewer days in 1949, the total worktime declined 13 percent from 1948. The "steel" strike that lasted from October 1 until the first half of November virtually closed the iron-ore-mining industry during this period. The average employee at iron mines worked

a 8.02-hour work shift and accumulated a total of 1,977 hours of work during 1949 compared with 2,304 hours in 1948.

Copper Mines.—The safety record at copper mines improved sharply during 1949. The fatality frequency rate of 0.35 was less than half that of the preceding year and resulted from the 61-percent drop in the number of fatal injuries. The number of nonfatal injuries was reduced 28 percent from 1948, and the resulting frequency rate of 32.76 per million man-hours represented a 17-percent improvement. The average number of men working daily declined to 15,800 in 1949. These men worked 32 days less than in 1948 and had an aggregate worktime of 34,490,000 man-hours, 13 percent below 1948. The work stoppage at a large open pit, which had started in the latter part of 1948, ended during the first half of February 1949. The average length of shift of 8.00 hours was unchanged from 1948; but, due to the smaller number of active mine days, the average employee worked 2,183 hours in 1949, or 255 less than in 1948.

Lead-Zinc Mines.—Fatality experience at lead-zinc mines was worse than in 1948. There were 28 fatal injuries in 1949, and the frequency rate increased 35 percent to 0.88 per million man-hours. As the decline in number of nonfatal injuries was greater proportionally than the decrease in man-hours of exposure, the nonfatal-injury frequency rate improved by 2 percent in 1949. The slight decline in employment, together with the smaller number of days active, caused a 6-percent decline in total man-hours worked. The average employee had a 7.99-hour work shift and a total of 2,009 hours of work during the year, or 103 hours less than in 1948.

Gold-Silver Lode Mines.—The fatality record was improved at gold-silver lode mines, but the nonfatal-injury record was not as good as in 1948. The total of 10 fatals was 3 less than in 1948. They occurred at a frequency of 0.96 per million man-hours, a 17-percent improvement. There was only a slight reduction in the number of nonfatal injuries; and, as the total worktime was reduced in greater proportion, the nonfatal-injury frequency rate increased 7 percent to 92.79 per million man-hours in 1949. The average number of men working declined 9 percent from 1948. Although these men worked 7 more days in 1949, the aggregate worktime declined 8 percent from 1948. The average shift in 1949 was 7.74 hours, a reduction from the 7.85-hour shift in 1948. The average employee worked 2,167 hours during 1949, or 20 more than in 1948.

Gold Placer Mines.—There were no fatal injuries at gold placers during 1949, whereas one occurred in 1948. The total of 190 nonfatal injuries was 10 more than in 1948, and the frequency of occurrence of these increased 17 percent to a rate of 28.49 in 1949. Because both employment and the average number of days active were lower than in 1948, the total man-hours of work declined 10 percent in 1949. The average employee worked 8.61 hours per day and accumulated a total of 1,906 hours during 1949.

Miscellaneous Metal Mines.—Fatality experience at miscellaneous metal mines improved. The two fatal injuries occurred at a rate of 0.34 per million man-hours in 1949, a 26-percent betterment over 1948. There was a slight increase in the number of nonfatal injuries; and this increase, together with the reduced man-hours of exposure,

resulted in a nonfatal-injury frequency rate 17 percent higher than in 1948. Employment declined slightly from 1948; and, because these mines were active 19 less days, the aggregate worktime during 1949 was 11 percent below 1948. There was a slight reduction in the average length of shift to 7.99 hours in 1949. The average worker accumulated 2,100 hours during 1949, or 185 less than in 1948.

NONMETAL MINES (EXCEPT STONE QUARRIES)

Employment gained slightly in 1949 to a total of 12,300 men at work daily in this group of nonmetal mines, which comprises barite, feldspar, fluorspar, gypsum, magnesite, mica, phosphate rock, rock salt, sulfur, and miscellaneous nonmetallic-mineral operations. However, as the operations were active an average of 276 days or 11 less than in 1948, the total hours of worktime during 1949 were slightly less than in the preceding year. The injury record in nonmetal mines improved in 1949. The total of 10 fatal injuries was lower than in any year since 1939. They occurred at a rate of 0.37 per million man-hours. The degree of improvement in the nonfatal-injury record was not as sharp as with fatalities. The nonfatal injuries occurred at a rate of 41.64 per million man-hours, which was lower than in any other year since 1939.

Employment and injury experience at nonmetal mines (except stone quarries) in the United States, 1945–49 [1]

Year	Men working daily	Average active mine-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
1945	10,371	291	3,015,980	24,612,921	16	1,145	0.65	46.52
1946	11,312	291	3,296,626	26,876,871	26	1,369	.97	50.94
1947	12,176	292	3,554,901	28,809,150	12	1,308	.42	45.40
1948	11,950	287	3,432,304	27,784,119	15	1,176	.54	42.33
1949 (preliminary)	12,300	276	3,392,000	27,380,000	10	1,140	.37	41.64

[1] Includes barite, feldspar, fluorspar, gypsum, magnesite, mica, phosphate rock, rock salt, sulfur, and miscellaneous nonmetallic-mineral mines.

STONE QUARRIES

Injury experience in the quarrying industries was appreciably better in 1949 than in 1948. The 65 fatal injuries during the year occurred at a rate of 0.37 per million man-hours, a decrease of 12 percent from 1948. The number of nonfatal injuries declined 404 to a total of 4,590 during 1949. The nonfatal-injury frequency rate of 25.96 was 7 percent lower than in 1948.

The average number of men working daily during 1949 advanced 3 percent to a total of 79,900. Due to 10 fewer working days, these men worked an aggregate of 176,800,000 man-hours or slightly less than in 1948. The average length of shift fell slightly to 8.07 hours in 1949. As a result of the reductions in active plant-days and length of shift, the average employee in the quarry industry worked 2,213 hours in 1949 compared with 2,316 hours in 1948.

Cement Quarries.—The cement industry had the sharpest improvement in injury experience among the quarry industries. The rate for

the 18 fatal injuries in 1949 was 0.24 per million man-hours or 27 percent below 1948. Likewise, the nonfatal-injury frequency rate was reduced 21 percent from 1948 to 8.46. This was the best annual frequency rate for nonfatal injuries in the cement industry since these rates were first compiled in 1931. Employment increased slightly to a total of 29,100 men working at cement plants. However, because there was 1 less day active, a slight reduction in the average length of shift worked, the aggregate worktime in 1949 was only 1 percent larger than in 1948. The average worker in 1949 had a shift of 7.83 hours.

Employment and injury experience at stone quarries in the United States, 1945–49, by industries

Industry and year	Men working daily	Average active mine-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Cement:[1]								
1945	20,858	285	5,944,040	48,078,750	9	600	0.19	12.48
1946	25,901	311	8,063,361	64,185,021	12	834	.19	12.99
1947	28,184	315	8,883,904	70,756,640	26	820	.37	11.59
1948	28,278	328	9,270,125	73,778,909	24	786	.33	10.65
1949 (preliminary)	29,100	327	9,503,000	74,450,000	18	630	.24	8.46
Limestone:								
1945	17,704	234	4,150,750	35,182,061	24	1,381	.68	39.25
1946	20,850	234	4,870,876	41,864,367	26	1,878	.62	44.86
1947	21,177	246	5,218,930	44,209,247	24	1,921	.54	43.45
1948	22,335	244	5,445,881	45,665,097	26	1,703	.57	37.29
1949 (preliminary)	23,800	221	5,265,000	44,200,000	25	1,625	.57	36.76
Lime:[1]								
1945	8,162	297	2,420,409	19,615,613	8	961	.41	48.99
1946	8,741	296	2,591,301	20,657,787	4	1,011	.19	48.94
1947	9,254	291	2,690,488	21,669,032	6	1,022	.28	47.16
1948	9,459	304	2,878,887	22,867,674	9	931	.39	40.71
1949 (preliminary)	9,300	302	2,813,000	22,070,000	10	815	.45	36.93
Marble:								
1945	1,748	256	446,645	3,792,968	2	164	.53	43.24
1946	2,370	260	616,200	5,292,992	------	173	------	32.68
1947	3,165	262	830,620	6,833,627	2	200	.29	29.27
1948	2,747	266	730,699	5,876,884	1	167	.17	28.42
1949 (preliminary)	3,300	259	855,000	6,810,000	------	220	------	32.31
Granite:								
1945	4,067	249	1,014,288	8,615,078	7	396	.81	45.97
1946	5,176	249	1,288,468	10,930,012	5	493	.46	45.11
1947	5,726	253	1,451,371	12,003,295	4	652	.33	54.32
1948	5,818	256	1,490,656	12,467,119	6	590	.48	47.32
1949 (preliminary)	6,000	250	1,501,000	12,770,000	3	535	.23	41.90
Traprock:								
1945	2,079	235	487,940	4,135,498	------	195	------	47.15
1946	2,493	244	607,405	5,125,217	3	221	.59	43.12
1947	2,470	242	597,234	5,080,337	3	261	.59	51.37
1948	2,505	238	594,938	5,064,034	4	257	.79	50.75
1949 (preliminary)	2,500	223	557,000	4,780,000	4	230	.84	48.12
Slate:								
1945	988	259	256,235	2,301,264	------	115	------	49.97
1946	1,323	274	361,855	3,330,047	2	181	.60	54.35
1947	1,740	267	465,449	4,174,220	3	243	.72	58.21
1948	1,952	262	512,126	4,511,472	3	188	.66	41.67
1949 (preliminary)	1,800	258	464,000	3,970,000	3	200	.76	50.38
Sandstone:								
1945	2,574	255	655,920	5,447,089	3	309	.55	56.73
1946	3,411	253	862,381	7,142,732	3	346	.42	48.44
1947	3,529	243	858,419	7,252,419	7	385	.97	53.09
1948	4,250	252	1,070,005	8,879,320	2	372	.23	41.90
1949 (preliminary)	4,100	229	937,000	7,750,000	2	335	.26	43.23
Total:								
1945	58,180	264	15,376,227	127,168,321	53	4,121	.42	32.41
1946	70,265	274	19,261,847	158,528,175	55	5,137	.35	32.40
1947	75,245	279	20,996,415	171,978,817	75	5,504	.44	32.00
1948	77,344	284	21,993,317	179,110,509	75	4,994	.42	27.88
1949 (preliminary)	79,900	274	21,895,000	176,800,000	65	4,590	.37	25.96

[1] Includes burning or calcining and other mill operations.

Limestone Quarries.—The safety record of limestone operations was slightly better in 1949 than in 1948 as a result of the improvement in nonfatal-injury experience. There were 25 fatalities, 1 less than in 1948. However, the fatality rate was unchanged from 1948, due to the shorter time of exposure to hazard in 1949. The fatality frequency rate has improved in only a slight degree in recent years. On the other hand, the frequency rate of nonfatal injuries has been lowered each year since 1946. Employment gained 7 percent in 1949, but because of an average of 23 fewer days of activity, the total man-hours of work was 3 percent below 1948. The average employee worked 1,857 hours during 1949, a decrease of 188 from 1948, because of the reduced number of active days. The average shift of 8.40 hours in 1949 was virtually the same as in 1948.

Lime Plants.—The nonfatal-injury frequency rate at lime plants in 1949 was improved 9 percent over 1948. However, the total of 10 fatals represented a frequency of 0.45 per million man-hours, which was less favorable than in 1948. The nonfatal-injury record at lime plants has improved appreciably each year since 1946, whereas the fatal record, as indicated by frequency rates, has become worse each year since 1946. A 2-percent decline in the average number of men working daily, together with two fewer days of work and a slightly shorter length of shift caused a 3-percent decline in the total man-hours worked in the industry during 1949. The average shift in 1949 was 7.85 hours.

Marble Quarries.—No fatal injuries were reported at marble quarries during 1949. The frequency of nonfatal injuries, however, increased 14 percent to 32.31 per million man-hours. Activity, as gaged by employment data, was at a higher level in 1949 than in 1948. The average number of men at work daily gained 20 percent over 1948, and the total man-hours of worktime showed a nearly similar gain of 16 percent. The average employee had a 7.96-hour shift and worked 2,064 hours during the year.

Granite Quarries.—Injury experience at granite operations improved considerably in 1949. There were three fatalities compared with six in 1948. The fatality frequency rate was less than half that of 1948; and for nonfatal injuries, the rate was 11 percent better. Employment increased 3 percent and the total worktime 2 percent in 1949. The average length of shift was increased to 8.51 hours in 1949, but the average worktime per employee for the year decreased slightly to a total of 2,128 hours because of an average of six fewer working days.

Traprock Quarries.—The frequency record of nonfatal injuries at traprock operations was improved 5 percent over 1948, and the rate was reduced to 48.12. Although there were four fatal injuries in each year, the frequency of fatalities in 1949 increased to 0.84 because the time of exposure was lower. The number of men worked daily was virtually unchanged from 1948 but as there were 15 fewer working days in 1949, the total man-hours declined 6 percent. The average employee worked 1,912 hours during 1949 and had a shift of 8.58 hours.

Slate Quarries.—Injury experience at slate operations was less favorable in 1949. The fatality frequency rate of 3 fatal injuries was 15 percent higher than in 1948, and the rate of occurrence of nonfatal injuries increased 21 percent. The increased frequency rates resulted largely from the reduced worktime in 1949. The average number of men working declined 8 percent to a total of 1,800 in 1949. These men worked 12 percent fewer man-hours and had an average daily shift of 8.56 hours. The average worktime per man-year was 2,206 hours, or 105 less than in 1948.

Sandstone Quarries.—The safety record at sandstone operations was less favorable than in 1948, and the frequency rates of both fatal and nonfatal injuries increased. There were 2 fatal injuries in each year, and nonfatal injuries dropped to 335 in 1949. The less favorable rates of occurrence resulted from a 13-percent decline in the aggregate worktime in the industry. Employment declined 4 percent, and there were 23 fewer days of work in 1949. The average worker had a shift of 8.27 hours and worked 1,890 hours during the year—199 less than 1948.

COKE PLANTS

The injury record at coke plants improved sharply in 1949. The fatality rate of 0.11 per million man-hours was the best in a statistical history, which started in 1916. The nonfatal-injury frequency rate of 11.04 was 16 percent better than in 1948 and was lower than in any other year since 1940. A total of 7 fatal and 690 nonfatal injuries occurred in 1949. Employment declined slightly to a total of 24,600 men, and the total man-hours worked during 1949 was 11 percent below 1948. Due to the effects of the strikes in the steel and coal-mining industries during 1949, coke plants were active an average of 320 days or 30 less than in 1948.

Byproduct Coke Plants.—The fatality frequency rate of 0.12 at byproduct-coke plants in 1949 was better than in any other year in the history of injury statistics on the industry. The frequency rate of nonfatal injuries was 9 percent lower than in 1948 and was the lowest annual rate since 1942. There were 7 fatal and 570 nonfatal injuries in 1949. The average number of men working daily declined slightly; however, the total man-hours worked at these plants during 1949 decreased 8 percent below 1948 because of the 16 fewer days of work in 1949. Byproduct coke plants were not affected materially by the strikes in the coal-mining industry, as coal stocks were maintained as high as possible through the year. However, the work stoppage in the steel industry in the latter half of the year caused the furnace plants to bank ovens. The average work shift in 1949 was 7.98 hours, virtually the same as in 1948.

Employment and injury experience at coke plants in the United States, 1945–49

Type and year	Men working daily	Average active plant-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Byproduct ovens:								
1945	20,454	356	7,290,410	59,292,507	17	647	0.29	10.91
1946	18,906	354	6,693,947	53,547,047	8	648	.15	12.10
1947	20,778	362	7,526,622	60,271,826	11	701	.18	11.63
1948	21,877	364	7,964,283	63,788,327	17	676	.27	10.60
1949 (preliminary)	21,200	348	7,383,000	58,930,000	7	570	.12	9.67
Beehive ovens:								
1945	2,533	247	625,031	5,082,575	1	188	.20	36.99
1946	2,504	204	510,740	4,163,075	------	162	------	38.91
1947	2,927	262	766,542	5,846,933	4	225	.68	38.48
1948	3,280	254	833,606	6,233,002	3	241	.48	38.67
1949 (preliminary)	3,400	140	477,000	3,550,000	------	120	------	33.80
Total:								
1945	22,987	344	7,915,441	64,375,082	18	835	.28	12.97
1946	21,410	337	7,204,687	57,710,122	8	810	.14	14.04
1947	23,705	350	8,293,164	66,118,759	15	926	.23	14.01
1948	25,157	350	8,797,889	70,021,329	20	917	.29	13.10
1949 (preliminary)	24,600	320	7,860,000	62,480,000	7	690	.11	11.04

Beehive-Coke Plants.—There were no fatal injuries at beehive-coke plants during 1949, whereas, in 1948 3 men were killed. The nonfatal-injury frequency of 33.80 per million man-hours was a 13-percent improvement over 1948 and was better than in any other year since 1938. Employment was slightly higher in 1949; but, as a result of the steel and coal strikes and of the 3-day week at coal mines, the beehive plants were active an average of only 140 days during the year, or 114 days less than in 1948. The aggregate worktime declined 43 percent in 1949. The average employee worked a 7.44-hour shift and had a total of 1,044 hours of work during the year or 856 less than in 1948.

METALLURGICAL PLANTS

The over-all fatality record at metallurgical plants was worse than in 1948 because of the sharp rise in fatality experience at nonferrous smelters, which more than offset an improvement at metal mills. The nonfatal-injury frequency of 22.49 was only slightly lower than in 1948. This slight improvement resulted from more favorable experience at metal mills which more than compensated for the slightly less favorable record at nonferrous smelters. There were 23 fatalities and 2,520 nonfatal injuries in 1949. Over-all employment at metallurgical plants changed only slightly from 1948. However, the aggregate man-hours of work in 1949 were 7 percent lower than in 1948 because the plants were active 23 fewer days.

Ore-Dressing Plants.—This group includes crushing, screening, washing, jigging, magnetic separation, flotation, and other milling operations on metallic ores. Injury experience at metal mills was better in 1949. There were 7 fatalities and the fatal frequency rate was reduced to 0.20 per million man-hours. The nonfatal injuries totaled 770, and the frequency of such injuries was reduced to 21.82. Fatal experience was better in each group of mills except iron mills, in which three men were killed in 1949 compared with none in 1948. The non-

fatal-injury experience was improved at each group except lead-zinc mills, in which there was virtually no change in rate of occurrence, and in miscellaneous metal mills, where the frequency rate increased sharply to 52.48 per million man-hours. The average number of men working daily increased for each group except gold-silver mills. The over-all gain was 6 percent. Although employment was slightly lower at gold-silver mills, the plants were active 16 more days in 1949, with the result that man-hours worked in this group were slightly higher than in 1948. At miscellaneous metal mills, the gain in employment resulted in an appreciable increase in man-hours worked in 1949. In the other groups of metal mills, the plants were active fewer days in 1949 than in 1948, and the man-hours of work declined slightly in each group in 1949. The average shift (8.01 hours) was unchanged from 1948.

Employment and injury experience at ore-dressing (metallic) plants in the United States, 1945–49, by industries [1]

Industry and year	Men working daily	Average active mill-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-fatal	Fatal	Non-fatal
Copper:								
1945	5,891	327	1,923,926	15,439,427	2	322	0.13	20.86
1946	5,579	279	1,555,028	12,435,937	1	322	.08	25.89
1947	5,846	323	1,887,600	15,100,609	2	288	.13	19.07
1948	6,308	317	1,998,932	15,998,431	4	289	.25	18.06
1949 (preliminary)	6,400	298	1,909,000	15,290,000	3	210	.20	13.73
Iron:								
1945	3,283	261	855,859	6,946,659	1	134	.14	19.29
1946	3,286	190	623,715	5,096,279	1	67	.20	13.15
1947	3,343	245	820,014	6,662,689	2	86	.30	12.91
1948	3,259	267	870,632	7,040,488	------	101	------	14.35
1949 (preliminary)	3,600	214	769,000	6,220,000	3	80	.48	12.86
Gold-silver:								
1945	600	294	176,380	1,383,341	------	48	------	34.70
1946	1,015	263	267,053	2,077,925	1	89	.48	42.83
1947	1,107	282	312,564	2,450,112	1	138	.41	56.32
1948	919	287	263,644	2,064,381	1	106	.48	51.35
1949 (preliminary)	900	303	273,000	2,140,000	------	65	------	30.37
Lead-zinc:								
1945	4,368	304	1,329,693	10,650,753	5	400	.47	37.56
1946	4,388	276	1,212,603	9,720,505	6	303	.62	31.17
1947	4,384	264	1,158,113	9,291,639	2	270	.22	29.06
1948	3,998	263	1,050,895	8,430,578	3	237	.36	28.11
1949 (preliminary)	4,100	250	1,026,000	8,210,000	1	235	.12	28.62
Miscellaneous metals: [2]								
1945	1,650	292	482,379	3,885,264	1	128	.26	32.94
1946	1,329	259	344,264	2,750,897	1	85	.36	30.90
1947	1,257	269	338,547	2,707,720	------	89	------	32.87
1948	1,150	280	321,751	2,570,479	1	101	.39	39.29
1949 (preliminary)	1,600	267	427,000	3,430,000	------	180	------	52.48
Total:								
1945	15,792	302	4,768,237	38,305,444	9	1,032	.23	26.94
1946	15,597	257	4,002,663	32,081,543	10	866	.31	26.99
1947	15,937	283	4,516,838	36,212,769	7	871	.19	24.05
1948	15,634	288	4,505,854	36,104,357	9	834	.25	23.10
1949 (preliminary)	16,600	265	4,404,000	35,290,000	7	770	.20	21.82

[1] Includes crushers, grinders, washers, ore concentrators, and sintering, cyaniding, leaching, and other ore-dressing plants and auxiliary works.
[2] Includes aluminum, antimony, chromium, manganese, mercury, molybdenum, tungsten, vanadium, and other metals.

Nonferrous Reduction Plants and Refineries.—The reduction plants and refineries in this classification are engaged in the primary extraction of nonferrous metals from ores and concentrates and the refining of crude primary nonferrous metals. Iron and steel plants are excluded.

Injury experience at nonferrous smelters and refineries was less favorable in 1949. The total of 16 fatalities occurred at a rate of 0.21 per million man-hours compared with 5 fatal injuries and a rate of 0.06 in 1948. The fatality frequency rate was worse at each group of smelters except at miscellaneous metal smelters, at which the rate was unchanged from 1948. Nonfatal-injury experience was slightly better at copper and lead smelters, but these improvements were more than offset by less favorable frequencies at zinc and miscellaneous-metal smelters. Employment declined slightly at each group of smelters except at lead smelters. Man-hours worked declined in each group and the over-all decrease in worktime for smelters was 10 percent from 1948. Plants in each group of smelters were active fewer days in 1949; for all smelters, the average plant was active 309 days—21 less than in 1948.

Employment and injury experience at primary nonferrous reduction and refinery plants in the United States, 1945–49, by industries [1]

Industry and year	Men working daily	Average active smelter-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Copper:								
1945	10,420	347	3,612,376	28,947,308	4	541	0.14	18.69
1946	10,187	289	2,946,354	23,572,764	6	503	.25	21.34
1947	12,393	322	3,992,485	31,938,431	7	726	.22	22.73
1948	12,419	326	4,053,333	32,495,627	2	592	.06	18.22
1949 (preliminary)	11,900	301	3,579,000	28,630,000	8	510	.28	17.81
Lead, silver-lead:								
1945	3,698	323	1,193,484	9,538,276	2	177	.21	18.56
1946	3,848	255	980,243	7,844,293	------	160	------	20.40
1947	3,679	331	1,219,309	9,750,024	4	197	.41	20.21
1948	4,037	323	1,302,463	10,419,706	1	188	.10	18.04
1949 (preliminary)	4,100	308	1,262,000	10,100,000	2	170	.20	16.83
Zinc:								
1945	9,944	350	3,482,249	27,701,226	1	857	.04	30.94
1946	9,917	338	3,356,262	26,199,631	4	915	.15	34.92
1947	10,484	345	3,616,035	28,667,924	1	994	.03	34.67
1948	9,843	342	3,367,815	26,875,360	1	843	.04	31.37
1949 (preliminary)	9,600	317	3,044,000	24,120,000	5	790	.21	32.75
Miscellaneous metals: [2]								
1945	6,613	334	2,211,852	16,998,447	3	664	.18	39.06
1946	5,405	277	1,496,988	11,974,531	------	350	------	29.23
1947	6,589	305	2,007,873	16,061,153	2	440	.12	27.40
1948	5,835	324	1,891,583	15,132,655	1	292	.07	19.30
1949 (preliminary)	5,500	316	1,738,000	13,900,000	1	280	.07	20.14
Total:								
1945	30,675	342	10,499,961	83,185,257	10	2,239	.12	26.92
1946	29,357	299	8,779,847	69,591,219	10	1,928	.14	27.70
1947	33,145	327	10,835,702	86,417,532	14	2,357	.16	27.27
1948	32,134	330	10,615,194	84,923,348	5	1,915	.06	22.55
1949 (preliminary)	31,100	309	9,623,000	76,750,000	16	1,750	.21	22.80

[1] Includes roasting, electrolytic, retort, and other nonferrous metal reduction and refinery plants.
[2] Includes antimony, magnesium, mercury, and tin plants.

PART II. COMMODITY REVIEWS

Abrasive Materials

By Robert W. Metcalf

GENERAL SUMMARY

BOTH increased and decreased output was recorded in the abrasive industry in 1949. Output of pumice and pumicite rose to a new record, and diatomite increased slightly over the high level of 1948. Sales of tripoli and emery were somewhat less than in 1948, and sales of quartz, grindstones, and garnet decreased substantially. Production of silicon carbide in 1949 increased 7 percent to the highest figure since the record year 1943. Production of aluminum oxide and shipments of metallic abrasives in 1949 were 19 and 29 percent, respectively, below the previous year.

The total value of imports of natural and artificial abrasive materials in 1949 declined 42 percent from that in 1948. Imports of diamond bort, carbonados and ballas, and diamond dust dropped sharply, as did corundum ore. On the other hand, receipts of emery ore and crude pumice were larger than in 1948. Silicon carbide and

Salient statistics of the abrasives industries in the United States, 1948–49

	1948		1949		Percent of change in 1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Natural abrasives (domestic) sold or used by producers:						
Diatomite	(1)	(1)	(1)	(1)		
Tripoli	26,845	$705,523	25,525	$690,564	−5	−2
Quartz	161,861	750,667	107,552	475,491	−34	−37
Ground sand and sandstone	692,773	5,778,277	610,789	5,258,464	−13	−10
Grindstones	7,921	402,667	4,479	244,704	−43	−39
Pulpstones	33	2,100	28	1,975	−15	−6
Millstones	(2)	17,733	(2)	9,490		−47
Tube-mill liners	1,297	41,555	1,166	47,093	−10	+13
Grinding pebbles	4,026	101,583	2,374	64,038	−41	−37
Pumice and pumicite	607,746	2,501,906	716,742	2,369,082	+18	−5
Garnet	8,039	587,797	6,578	505,231	−18	−14
Emery	5,495	69,408	4,989	60,917	−9	−12
Artificial abrasives:						
Silicon carbide—production [3]	63,033	5,874,731	67,539	6,055,763	+7	+3
Aluminum oxide—production [3]	154,972	10,279,583	125,806	8,500,074	−19	−17
Metallic abrasives (steel shot and grit)—shipments	147,218	15,174,773	104,778	9,312,368	−29	−30
Foreign trade (natural and artificial abrasives):						
Imports		[4] 45,165,069		26,336,325		−42
Exports		[4] 15,267,670		17,447,399		+14

[1] Average annual figure for 1945–47 was 213,588 short tons valued at $4,307,988; Bureau of Mines not at liberty to publish annual data separately.
[2] Tonnage not recorded.
[3] Includes Canadian production.
[4] Revised to include data for artificial abrasives.

aluminum oxide imports were about one-quarter less in 1949. Imports of iron and steel grit, shot, and sand are small in actual volume but showed a very high proportional increase.

This chapter includes data for most of the materials used for abrasive purposes, but certain clays, carbides, oxides, and other substances noted later under Miscellaneous Mineral Abrasive Materials are not included in the statistics shown herein. Certain of the abrasive products for which figures are given also have important nonabrasive uses.

Natural and artificial abrasives were compared[1] in the literature; and developments in the abrasive industries were presented, particularly the processing of garnet and the preparation of the hard carbides.[2] Mechanical polishing methods and agents were reviewed,[3] and precision tumbling procedures outlined.[4]

NATURAL SILICA ABRASIVES

Diatomite.—The high levels achieved in the production of diatomite in recent years were continued in 1949. Output data for that year, however, may not be published by the Bureau of Mines, as they would reveal statistics of individual companies. Annual production for the 3-year period 1945–47 averaged 213,588 short tons valued at $4,307,088, compared with 174,957 tons valued at $3,298,178 for 1942–44 and 120,167 tons valued at $1,915,405 for 1939–41.

Diatomite was produced for sale in 1949 in four States—California, Oregon, Nevada, and Washington. The largest producer was California. Increases were reported in three of the four States reporting production. Major uses for which diatomite was consumed, with the approximate portion indicated for each use, follow: Filtration, about three-fifths of the total; fillers, about one-quarter; insulation, about one-tenth; and other uses, including abrasives, the remainder.

Recent developments in the industry included discontinuance of the operations of the General Diatomite Co., Fallon, Nev., and abandonment of its Kittitas, Wash., plant by the Great Lakes Carbon Corp., Dicalite Division, Los Angeles, Calif. The latter firm was reported to have purchased during 1949 the former Diatoms, Inc., operation near Bradley, Calif. The Quincy Corp., 901 Chrysler Building, New York, N. Y., acquired the assets and business of the Dia-Cousti-Lite Products Co., Quincy, Wash. A description of the Dia-Cousti-Lite operations was published.[5] As of January 1, 1950, the Corliss-Kaiser Co., Inc., Yakima, Wash., was reorganized and the name of the firm changed to Kaiser Mining & Manufacturing Co., Inc., with offices at 205 Mercy Building, Yakima, Wash. Recovery and milling operations at the Johns-Manville Products Corp. plant at Lompoc, Calif., were described.[6]

[1] Lefebre, A., Abrasives: Ind. Ceram., 1947, No. 374, p. 280, No. 380, p. 299; British Ceram. Abs., 1948, 185A; British Abs., B–I, October 1948, p. 554.

[2] Seymour, H., Developments in Abrasives: Mining Mag. (London), 1948, 78, No. 1, 20; British Ceram. Abs. 1948, 350A; British Abs., B–I, March 1949, p. 206.

[3] Frydlender, J. H. [Polishing Metals and Polishing Agents]: Rev. prod. chim., 1946, vol. 48, No. 2, pp. 15–18, 22–26; No. 3, pp. 15–31, 42–43, 45; Jour. Iron and Steel Inst. 1948, 158, 404; British Abs., B–I, August 1948, p. 422.

[4] Lord, R. M., Precision Tumbling Metal Parts: Steel, 1947, vol. 121, No. 24, pp. 93–94, 124; British Abs., B–I, August 1948, p. 422.

[5] Rock Products, Reclaiming Diatomaceous Earth: Vol. 52, No. 7, July 1949, p. 80.

[6] Huttl, J. B., Diatomite, Its Mining and Processing: Eng. and Min. Jour., vol. 150, No. 8, August 1949, pp. 75–77 (flow sheet).

As quoted in E&MJ Metal and Mineral Markets, price quotations of diatomite during 1949 continued unchanged from previous years as follows (per ton, crude, in bulk, dried, nominal): Nevada—98- to 100-mesh, $25; low-temperature insulation, $25; high-temperature insulation, $40; fine abrasive, 2 to 3 cents per pound (bags are extra); California filtration grades, $20 to $50 per ton f. o. b. mill.

The use of diatomaceous earth in making a lightweight aggregate for concrete was described, and its advantages were set forth.[7] Treating finely ground diatomite with air-entraining agents resulted in much improved workability and less bleeding and segregation, as well as lower water requirements and less drying shrinkage than for ordinary concrete.[8] It was claimed that resistance to freezing and thawing also was greatly increased.

Filtration of sulfur through diatomaceous earth to remove fly ash and other airborne dusts picked up during transportation and storage proved successful, according to the trade press.[9] An automatic, self-renewing filtering system using diatomite as a filter aid was said to be satisfactory for all types of difficult electroplating solutions, including those from cyanide plating tanks and those composed of iron and aluminum hydrides.[10] Diatomite filters for swimming pools were described.[11] A brief account of the use of diatomite as in inert filler in both natural and synthetic rubber was given in an article on inorganic mineral substances used in the rubber industry.[12]

French occurrences of diatomites were described.[13] Recoverable reserves of diatomite on the Scottish Isle of Skye have been estimated at from 250,000 to 300,000 tons,[14] and a limited production was obtained during 1949.[15] Descriptions of Japanese diatomite deposits and discussion of possible industrial applications were published in a series of papers.[16] Swedish use of diatomaceous earth in making porous insulating brick was noted.[17] Treatment of English cider with a diatomaceous filter aid improved the quality of the product, it was claimed.[18]

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[7] Dolman, S. G., Airox Concrete Aggregate: California Jour. Mines and Geol., vol. 40, No. 1, pp. 131–133, 1944; abs. in Jour. Am. Ceram. Soc., vol. 32, No. 5, May 1, 1949, p. 126. Pit and Quarry, vol. 41, No. 9, March 1949, p. 173.

[8] Davis, Raymond E., and Klein, Alexander, The Effect of the Use of Diatomite Treated with Air-Entraining Agents upon the Properties of Concrete: Rock Products, vol. 52, No. 12, December 1949, p. 127.
Davis, R. E., Use of Pozzolans in Concrete: Am. Concrete Inst. Jour., vol. 21, No. 5, January 1950, pp. 377–384.

[9] Lee, J. A., Filtration Solves Sulphur Difficulties: Chem. Eng., vol. 55, No. 4, April 1948, pp. 119–121.

[10] Metal Finishing, Filtering System for Plating Tanks: Vol. 47, No. 10, October 1949, pp. 96–97.
Chemical and Engineering News, vol. 27, No. 43, Oct. 24, 1949, p. 3161.

[11] Kiker, J. E., Jr., Diatomite Filters for Swimming Pools: Am. Water Works Assoc. Jour., vol. 41, September 1949, pp. 801–809.

[12] California Journal of Mines and Geology, Description of Inorganic Mineral Materials Used in the Rubber Industry: Vol. 45, No. 4, October 1949, p. 557.

[13] Charrin, V. [Kieselguhrs of the Touraine]: Génie civil, vol. 125, No. 21, 1948, pp. 412–413; Am. Ceram. Soc. Jour., vol. 32, No. 4, Apr. 1, 1949, p. 115 (abs.).
Chemical Age (London), Some Characteristics of French Kieselguhr; Parallels With Diatomite: Vol. 61, No. 1589, Dec. 24, 1949, p. 882.

[14] Chemical Age (London), vol. 60, No. 1546, Feb. 26, 1949, p. 337; Chem. and Ind., Feb. 26, 1949, No. 9, p. 147.

[15] Chemical Age (London), vol. 61, No. 1573, Sept. 3, 1949, p. 331.

[16] Kawashima, Chihiro, and Shiraki, Yoichi, Fundamental Studies on Japanese Diatomaceous Earths and Their Industrial Applications, VII, VIII, IX, and X: Jour. Japanese Ceram. Assoc., vol. 49, No. 583, pp. 400–408; No. 588, pp. 721–728, 1941; vol. 50, No. 591, pp. 98–104; No. 593, pp. 203–211, 1942; Jour. Am. Ceram. Soc., vol. 32, No. 8, Aug. 1, p. 191; No. 9, Sept. 1, p. 216; Oct. 1, p. 241 (1949).

[17] American Ceramic Society Bulletin, Brick Research: Vol. 28, No. 4, April 15, 1949, p. 166.

[18] Crang, A., James, D., and Sturdy, M., Domestic Apple Juice Production, Progress Report: A. R. Agric. Hort. Res. Sta., Bristol, 1946, pp. 140–144; British Abs., February 1949, p. 88

Tripoli.—Sales of tripoli, amorphous silica, and rottenstone in 1949 totaled 25,525 short tons, valued at $690,564, a decrease of 5 percent in tonnage and 2 percent in value compared with 1948, although considerably above the levels of the war years 1942 to 1945. States in which these materials were produced in 1949 were Illinois, Missouri, and Pennsylvania.

The chief use of tripoli in 1949 was as an abrasive in polishing and buffing compositions. Partly estimated data indicated a decline for this purpose and a small increase in the market for fillers. Miscellaneous uses, including foundry facing and rotary drilling mud, decreased somewhat in 1949.

Tripoli[1] sold or used by producers in the United States, 1943–46 and 1947–49, by uses

Year and use	Short tons	Value	Year and use	Short tons	Value
1943	14,912	$244,365	1948: Abrasives	22,193	$606,402
1944	18,425	301,863	Filler	2,723	45,000
1945	18,247	306,829	Foundry facing, etc.	1,929	54,121
1946	28,955	549,099	Total	26,845	705,523
1947: Abrasives	29,866	654,232	1949: Abrasives	20,972	587,241
Filler	2,573	47,640	Filler	2,820	53,938
Foundry facing, etc.	2,139	49,550	Foundry facing, etc.	1,733	49,385
Total	34,578	751,422	Total	25,525	690,564

[1] Including Pennsylvania rottenstone.

Quotations on tripoli in E&MJ Metal and Mineral Markets remained throughout 1949 at the same levels as in recent preceding years (per short ton, f. o. b. Missouri, in paperlined burlap bags, minimum carlots 30 tons): Once-ground, through 40-mesh, rose or cream, $14.50; double-ground, through 110-mesh, rose or cream, $16; and air-floated, through 200-mesh, $26. Quotations appearing in Oil, Paint and Drug Reporter for dry-ground, 325-mesh amorphous silica, f. o. b. works, Illinois, remained at $20 to $30 per ton during 1949 for carlot shipments. Less-than-carlot shipments, which at the beginning of 1949 were quoted at $25 per ton, were changed to $25–$40 after April 1. The same journal quoted prices on rottenstone in 1949 as follows: $36 per short ton, at mines, in bags, for carlots, and $43 for less than carlots.

Companies producing tripoli, amorphous silica, and rottenstone in 1949 were: Illinois (amorphous silica)—Ozark Minerals Co., Cairo; Oklahoma (mines) and Missouri (mill)—American Tripoli Corp., Seneca, Mo.; and Pennsylvania (rottenstone)—Penn Paint & Filler Co., Antes Fort, and Keystone Filler & Manufacturing Co., Muncy. Two new firms have been organized to mine and process amorphous silica near Rogers, Ark.—Corona Silica Corp., 2240 Commerce Building, Houston 2, Tex., and Oak Ridge Minerals, Inc., Rogers, Ark. Milling equipment was being installed in 1949, but neither company was in production.

A description of Russian experiments in producing tripoli brick was published.[19] The use of tripoli and other materials as coating agents in mould washes, parting powders, and other refractory mixtures in the foundry was detailed.[20] Possible competitors of tripoli are buffing and polishing compounds said to be made from conglomerate sands.[21]

Polishing of gems (particularly sapphire) with tripoli and other polishing agents was described.[22] Although many lapidaries still prefer tripoli, it is said that the recently introduced micro-size grit diamond powder and synthetic sapphire polishing powder are replacing tripoli in the polishing of sapphire.

Quartz.—Sales of crude, crushed, and ground quartz from pegmatite veins or dikes and from quartzite in 1949 dropped 34 percent in tonnage and 37 percent in value compared with 1948, but the tonnage remained somewhat higher than in 1947. The total value for 1949 was topped only by that of 1948. Principal uses for which the re-

Quartz (crude, crushed, and ground) [1] sold or used by producers in the United States, 1945–49

Year	Crude		Crushed		Ground		Total	
	Short ton	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	24,392	$72,392	28,718	$93,631	4,654	$70,780	57,764	$236,803
1946	38,587	107,069	29,228	109,437	5,364	77,346	73,179	293,852
1947	21,940	118,231	62,169	170,254	17,208	136,040	101,317	424,525
1948	41,081	250,184	104,496	374,781	16,284	125,702	161,861	750,667
1949	15,816	74,562	72,432	257,213	19,304	143,716	107,552	475,491

[1] To avoid duplication, the ground material shown here is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.

Quartz (crude, crushed, and ground) [1] sold or used by producers in the United States, 1947–49, by States

State	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona, California, Oregon, Washington	54,137	$255,044	91,926	$493,481	51,185	$212,114
Connecticut					16,225	97,350
Massachusetts	1,019	9,185	792	7,288	577	4,265
Other States [2]	46,161	160,296	69,143	249,898	39,565	161,762
Total	101,317	424,525	161,861	750,667	107,552	475,491

[1] To avoid duplication, the ground material included is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.

[2] 1947–48: Maryland, North Carolina, South Dakota, Tennessee, and Wisconsin; 1949: Maryland, North Carolina, and Wisconsin.

[19] Sobolev, M. A. [Production of Brick from Tripoli], Steklo i Keram., vol. 5, No. 6, 1948, pp. 20–21; Am. Ceram. Soc. Jour., vol. 32, No. 4, Apr. 1, 1949, p. 107 (abs.).

[20] Guedras, M. Métallurgie, 1947, 79, No. 6, 13–14; Jour. Iron & Steel Inst., 1948, pp. 158, 398; British Abs. BI–6, August 1948, p. 408.

[21] Engineering and Mining Journal, vol. 150, No. 4, April 1949, p. 134.

[22] Batchelor, H. H., Tripoli Polishing: Mineralogist, vol. 17, No. 7–8, July–August 1949, p. 384.

ported tonnage was consumed included the manufacture of ferrosilicon and glass, with smaller quantities for abrasives and as an ingredient in pottery, porcelain, or tile.

Tonnages reported as crude and crushed quartz in 1949 declined sharply, and ground material increased 19 percent in quantity and 14 percent in value compared with 1948. These statistics do not include sales of quartzite to cement mills and certain sales of quartz or quartzite for use in the manufacture of ferrosilicon. Production in each of the States or groups of States given in the accompanying table, except Connecticut, showed large decreases.

The average value of the total quartz reported in this section was $4.42 in 1949 compared with $4.64 in 1948 and $4.19 in 1947. Price quotations at the beginning of 1949 on "hard-quartz" silica (99½ percent grade), as reported in Oil, Paint and Drug Reporter, were as follows: 325-mesh, carlots, in bags, $15 per net ton, and less than carlots, $20 per ton; and 140-mesh, carlots, in bags, $10 per ton, and less than carlots, $15 per ton. After April 1, these quotations were raised to $20 per ton for 325-mesh, carlots, in bags; $25 for less carlots; and $12 per ton for 140-mesh, carlots, in bags; $17 for less than carlots, and remained at these levels for the balance of the year. A survey of quartz, quartzite, and other silica deposits in North Carolina was published.[23]

Ground Sand and Sandstone.—Sales of ground sand and sandstone in 1949 decreased 12 percent in tonnage and 9 percent in value from the record year 1948 and totaled 610,789 short tons valued at $5,258,464. The average value per ton in 1949 increased to $8.61, compared with revised values for 1948 and 1947 of $8.34 and $8, respectively. Illinois, the largest producing State, accounted for 36 percent of the total sales and showed a 7-percent loss from 1948 output. Production in all other States for which data are shown was less than in 1948, including a small decline for Ohio, Virginia, and West Virginia combined. The larger producing States, other than Illinois, were New Jersey, Ohio, Pennsylvania, and West Virginia.

Ground sand and sandstone sold or used by producers in the United States, 1945–49

Year	Short tons	Value	Year	Short tons	Value
1945	533,656	$3,709,597	1948	[1] 692,773	[1] $5,778,277
1946	575,888	4,125,398	1949	610,789	5,258,464
1947	[1] 644,508	[1] 5,154,264			

[1] Revised figure.

[23] Broadhurst, Sam D., A General Survey of Some High Silica Materials in North Carolina: North Carolina Division of Mineral Resources Inc Circ. 7, Raleigh, N. C., 1949, 30 pp.

Ground sand and sandstone sold or used by producers in the United States, 1947–49, by States

State	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Georgia	[1] 4,419	[1] $30,971	[1] 1,909	[1] $17,183	771	$7,712
Illinois	198,500	1,614,173	232,971	1,943,284	217,577	1,887,144
Massachusetts	1,944	11,628	2,150	14,000	1,514	9,650
New Jersey	118,446	772,213	116,832	782,644	107,946	755,215
Ohio, Virginia, and West Virginia	177,048	1,568,756	193,289	1,781,053	192,134	1,776,717
Washington	(2)	(2)	6,682	33,783	(2)	(2)
Other States [3]	144,151	1,156,523	138,940	1,206,330	90,847	822,026
Total	[1] 644,508	[1] 5,154,264	[1] 692,773	[1] 5,778,277	610,789	5,258,464

[1] Revised figure.
[2] Included with "Other States."
[3] California, Missouri, Oklahoma (1949), Pennsylvania, Texas (1948), Washington (1947 and 1949), and Wisconsin.

The chief consumers of ground sand and sandstone in 1949 were the pottery, porcelain, and tile industries (37 percent of the tonnage for which uses were reported), abrasives industries, chiefly cleansing and scouring compounds (23 percent), foundries (13 percent), glass (6 percent), and filler (6 percent). Enamel and miscellaneous comprise the balance of the tonnage for which data were given. Only fillers showed an increase in 1949 over 1948. The distribution by uses in 1949 was based on reports from companies accounting for 93 percent of the total sales.

Ground sand and sandstone sold or used by producers in the United States in 1949, by uses [1]

Use	Short tons	Value	
		Total	Average per ton
Abrasive:			
Cleansing and scouring compound	130,103	$1,066,881	$8.20
Other	620	4,748	7.66
Enamel	30,446	224,134	7.36
Filler	36,236	308,895	8.52
Foundry	73,134	602,406	8.24
Glass	33,219	251,882	7.58
Pottery, porcelain, and tile	209,771	2,002,657	9.55
Other uses	54,060	418,821	7.75
Total reported by uses	567,589	4,880,464	8.60

[1] Data represent 93 percent of the industry.

Abrasive Sands.—Considerable tonnages of natural sands with a high silica content are sold for abrasive purposes, such as glass grinding, stone polishing, coating sandpaper, and sand blasting. Sales of these abrasive sands in 1949 totaled 1,080,886 short tons valued at $2,063,866 compared with 1,119,802 tons valued at $2,151,095 in 1948. The 1949 figures include 393,427 tons of blast sand valued at $1,222,513 an increase of 3 percent in both quantity and value compared with 1948. Detailed data regarding tonnages produced in each State appear in the Sand and Gravel chapter of this volume.

SPECIAL SILICA-STONE PRODUCTS

clined [illegible] lowest point of recorded output, and the value was the lowest since 1938. As in recent years, grindstones were reported from Ohio and West Virginia and pulpstones from Washington.

Grindstones and pulpstones sold by producers in the United States, 1945–49

Year	Grindstones		Pulpstones		
	Short tons	Value	Quantity		Value
			Pieces	Equivalent short tons	
1945	10,033	$399,565	(1)	(1)	(1)
1946	11,605	501,444	22	72	$3,880
1947	10,620	476,811	24	76	4,976
1948	7,921	402,667	12	33	2,100
1949	4,479	244,704	7	28	1,975

[1] Bureau of Mines not at liberty to publish figure.

Oilstones and Other Sharpening Stones.—Output of natural sharpening stones was smaller in 1949 than in 1948. The Bureau of Mines is not at liberty to publish the figures. Producing States in 1949 and type of abrasive stones reported from each follow: Arkansas—oilstones and whetstones; Indiana—whetstones and rubbing stones; New Hampshire—scythestones; and Ohio—scythestones, whetstones, and rubbing stones (holystones).

Millstones.—The value of sales of millstones in 1949 was slightly less than half that in 1948 and was the lowest since 1943. No chasers were reported in 1949. States marketing millstones in 1949 were North Carolina (Rowan County) and Virginia (Montgomery County).

Value of millstones and chasers sold by producers in the United States, 1944–49 [1]

Year	Number of producers	Value	Year	Number of producers	Value
1944	3	$9,700	1947	4	$23,189
1945	4	15,018	1948	3	17,733
1946	4	14,780	1949	2	9,400

[1] Produced in Minnesota (1945 only), New York (1944–48), North Carolina, and Virginia.

Grinding Pebbles and Tube-Mill Liners.—The tonnage and value of grinding pebbles sold or used in 1949 dropped sharply compared with 1948. The quantity of tube-mill liners also declined somewhat in 1949, although the realization increased. As in 1948, States from which grinding pebbles were reported in 1949 were: California, Minnesota, North Carolina, Texas, Washington, and Wisconsin. Tube-mill liners were reported from Minnesota, North Carolina, and Wisconsin.

The following companies produced for sale the products indicated: Crystal Silica Co., Los Angeles, Calif., grinding pebbles; Jasper Stone Co., Sioux City, Iowa, liners and grinding pebbles (quarries in Minnesota); Harris Granite Quarries Co., Salisbury, N. C., liners and grinding pebbles; Dezendorf Marble Co., Austin, Tex., grinding pebbles; Mineral Products Co., Seattle, Wash., grinding pebbles; and Baraboo Quartzite Co., Baraboo, Wis., liners and grinding pebbles.

Grinding pebbles and tube-mill liners sold or used by producers in the United States, 1945–49

Year	Grinding pebbles		Tube-mill liners		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	8,615	$201,806	1,982	$45,933	10,597	$247,739
1946	4,652	102,043	2,375	44,247	7,027	146,290
1947	5,860	122,883	1,496	40,303	7,356	163,186
1948	4,026	101,583	1,297	41,555	5,323	143,138
1949	2,374	64,038	1,166	47,093	3,540	111,131

NATURAL SILICATE ABRASIVES

Pumice and Pumicite.—Output of pumice and pumicite (volcanic ash) in 1949 rose 18 percent compared with 1948 to 716,742 short tons, a record tonnage. The total value declined in 1949 but was higher than in any year except 1948. Pumice has been shipped in increasing quantities into the Middle West and South as an aggregate in lightweight concrete, an outlet that has developed rapidly in recent years. Much of this material has originated in the Southwest.

Pumice and pumicite sold or used by producers in the United States, 1944–49

Year	Short tons	Value	Year	Short tons	Value
1944	88,757	$704,110	1947	442,552	$2,021,880
1945	157,011	1,051,037	1948	607,746	2,501,906
1946	319,883	1,585,753	1949	716,742	2,369,082

Pumice and pumicite sold or used by producers in the United States, 1947–49, by States

State	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
California	169,037	$1,026,275	196,934	$1,110,447	149,878	$799,602
Idaho	98,618	119,882	79,426	93,602	71,373	105,360
Montana	2,035	9,476	(1)	(1)		
Nebraska	4,546	43,760	4,008	34,200	4,622	40,000
New Mexico	85,639	512,176	177,630	812,545	351,368	1,026,479
Oregon	33,240	111,380	106,277	307,274	104,475	273,427
Utah	7,500	30,000	7,618	30,472	(1)	(1)
Washington	26,497	74,173	26,675	47,787	8,610	18,221
Other States [2]	15,440	94,758	9,186	65,579	26,416	165,993
Total	442,552	2,021,880	607,746	2,501,906	716,742	2,369,082

[1] Included with "Other States".
[2] Alaska (1948), Arizona (1949), Colorado (1947), Kansas, Montana (1948), Nevada (1949), Oklahoma, Texas, and Utah (1949).

Production of pumice or pumicite was reported from 12 States in 1949 compared with 11 States and Alaska in 1948. New Mexico output nearly doubled, placing that State in first place in rank of producers, and accounted for 49 percent of the total sales. The second largest producing State was California, followed by Oregon and Idaho. Output in Oregon was slightly under that of 1948, and California and Idaho showed fairly large losses. Nebraska increased its output in 1949 compared with 1948. Combined sales of four States—New Mexico, California, Oregon, and Idaho—accounted for 94 percent of all the pumice and pumicite marketed in 1949. The average realization per ton declined to $3.31 compared with $4.12 in 1948 and $4.57 in 1947.

Pumice and pumicite sold or used by producers in the United States, 1947–49, by uses

Use	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Abrasive:						
Cleansing and scouring compounds and hand soaps	25,266	$323,885	16,005	$245,994	15,926	$188,823
Other abrasive uses	5,800	326,348	4,508	251,828	8,077	320,017
Acoustic plaster	5,427	163,360	3,612	109,498	10,018	182,990
Concrete admixture and concrete aggregate	397,223	1,083,630	559,697	1,665,727	672,592	1,559,587
Other uses [1]	8,836	124,657	23,924	228,859	10,129	117,665
Total	442,552	2,021,880	607,746	2,501,906	716,742	2,369,082

[1] Insecticide, insulation, brick manufacture, filtration, solvents, plastics, paint filler, absorbents, and unspecified.

Pumice and pumicite sold for concrete admixture and concrete aggregate in 1949 increased 20 percent over 1948 and totaled 672,592 short tons. Pumice used for abrasive purposes increased 17 percent and that used in acoustic plaster was over 2½ times that reported in 1948. Tonnages sold for "other uses" declined sharply in quantity and value. "Other uses" included absorbents, insecticides, insulation, paint filler, and miscellaneous. Consumption of pumice and pumicite for abrasive purposes in recent years has steadily decreased in importance, while its use in concrete has shown a very rapid growth. (See fig. 1.)

As reported in Oil, Paint and Drug Reporter, quotations on domestic and imported pumice in 1949 remained at the same levels as in 1948 and were as follows: Domestic coarse ground (sizes 0½, 1, 1½, 2, 3) in bags, ton lots, New York, 3⅝ to 4 cents per pound (Chicago, 4½ cents), smaller lots, 3⅞ to 4½ cents; fine ground, in bags, ton lots, 3⅜ cents per pound, smaller lots, 3⅝ to 4 cents; imported—Italian, silk-screened, fine, in bags, ton lots, 4 cents per pound, coarse, 5½ cents; sun dried, fine, in bags, ton lots, 3 cents per pound, coarse, 4½ cents. Pumice in barrels was quoted at ½ cent per pound higher. No quotations on pumicite are given in the trade press.

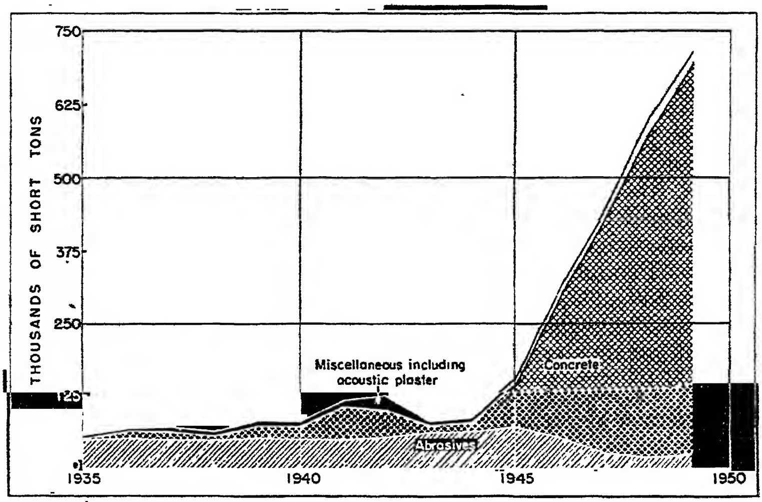

FIGURE 1.—Trends, by uses, of pumice and pumicite sold or used in the United States, 1935–49.

The operations of two plants serving the southern California region were described in the trade press.[24] Descriptions of other plants with photographs of plant and equipment, one in northern California [25] and another in the Idaho-Utah region,[26] were published. A pumice sizing plant in Oregon making aggregate, chicken grits, and soil conditioner was described.[27] A new operation on a large deposit of pumice in Wyoming planned to start production during the early part of 1950.[28]

The volcanic ash deposits in southwestern Oklahoma have been surveyed,[29] and a process was developed for making a bloated product for use as a lightweight construction material.[30] A study of the use of Oregon volcanic ash in the manufacture of glass was authorized by the Oregon State Department of Geology and Mineral Industries.[31] The University of New Mexico is making a survey of the pumice deposits in or near the Los Alamos reservation for the Atomic Energy Commission.[32]

Pumice as a lightweight aggregate continued to be a vital subject and evoked much interest during 1949. Among the articles on this

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[24] Utley, Harry F., W–W Pumice Company's Modern Plant Has Capacity of 500 Tons Daily: Pit and Quarry, vol. 42, No. 5, November 1949, pp. 113–116.
Rock Products, Scoria Reclaimed for Lightweight Aggregate: Vol. 52, No. 5, May 1949, p. 91.

[25] Rock Products, Basalt Rock Co. Entertains N. R. M. C. A. Directors: Vol. 52, No. 12, December 1949, pp. 160–162.

[26] Rock Products, Diversify Concrete Products Operation: Vol. 52, No. 6, June 1949, p. 170.

[27] Lenhart, W. B., Pumice Sizing Plant: Rock Products, vol. 52, No. 5, May 1949, pp. 90–91.

[28] Rock Products Plans Pumice Operation: Vol. 52, No. 12, December 1949, p. 118.

[29] Funnell, John E., Ceramic Materials of Southwestern Oklahoma: Am. Ceram. Soc. Bull., vol. 28, No. 12, Dec. 15, 1949, pp. 489–492.

[30] Burwell, Albert L., Making Cellular Products from Volcanic Ash: United States Patent 2,466,001, Apr. 5, 1949 (Apr. 23, 1947); Jour. Am. Ceram. Soc., vol. 32, No. 10, Oct. 1, 1949, p. 230 (abs.).

[31] Engineering and Mining Journal, vol. 150, No. 1, January 1949, p. 110.

[32] Engineering and Mining Journal, vol. 150, No. 2, February 1949, p. 141.

subject were a general survey of the mineral substances used for this purpose, published by the National Ready Mixed Concrete Association [33] and an investigation of the properties of lightweight aggregates by the National Bureau of Standards.[34] Lightweight insulating concretes also were discussed at length with mention made of the use of pumice for this purpose.[35] Pozzolanic materials including pumice and pumicite, their processing, and their advantages in the making of cement were investigated.[36] Portland pozzolan cement using pumicite has proved satisfactory in the construction of dams.[37]

Garnet.—Production of garnet in 1949 decreased to 6,578 short tons valued at $505,231, the lowest point since 1945 and 18 percent less in tonnage and 14 percent less in value than in 1948. The trend in output (sales) of garnet since 1920 is shown in figure 2. Producers reporting sales in 1949 were: Garnet Mines, Inc., Fernwood, Idaho; Idaho Garnet Abrasive Co., Inc., P. O. Box 1452, Spokane 6, Wash. (deposit near Fernwood, Idaho); Northern Minerals, Inc., Essex, N. Y.; and Barton Mines Corp., North Creek, N. Y. The advantages of using an Akins separator in the processing of garnet included lower milling costs, according to a recent article.[38] A brief description of the production and processing of abrasive garnet by Idaho Garnet Abrasive Co., Inc., in the Emerald Creek area of Idaho was published.[39] Rare Earths, Inc., Grangeville, Idaho, plans to produce garnet as a by-product of its monazite sand operations.[40]

Abrasive garnet sold or used by producers in the United States, 1944–49

Year	Short tons	Value	Year	Short tons	Value
1944	(1)	(1)	1947	8,722	$614,071
1945	6,306	$375,198	1948	8,039	587,797
1946	7,748	570,136	1949	6,578	505,231

1 Bureau of Mines not at liberty to publish figure.

As quoted in E&MJ Metal and Mineral Markets during 1949, the price of New York Adirondack garnet concentrates in grain form was given as $85 per net ton, the same as in recent years.

[33] Ralston, Oliver C., and Conley, John E., Lightweight Aggregates for Concrete: National Ready Mixed Concrete Assoc. Misc. Pub. 23, 1949. 14 pp.
[34] Pit and Quarry, Properties of Lightweight Aggregate Concretes: Vol. 42, No. 3, September 1949, pp. 175–177, 183.
[35] Castell, L. A., Lightweight Insulating Concretes: Rock Products, vol. 52, No. 2, February 1949, pp. 153–155, 164–165.
[36] Nordberg, Bror, Pozzolanic Materials Discussed by A. S. T. M.: Rock Products, vol. 52, No. 12, December 1949, pp. 102–105, 127–128, 136–138.
Cereseto, A., and Rio, A., [Nature and Action of Pozzolanous Cements]: Chem. e Ind., 30, 1948, pp. 261–264; British Abs., B–I, April 1949, p. 305.
[37] Rock Products, vol. 52, No. 12, December 1949, p. 105.
[38] Vogel, H. H., and Bitzer, E. C., Shift to New Separator Cuts Garnet Milling Costs: Eng. and Min. Jour., vol. 150, No. 8, August 1949, pp. 62–63 (flow sheets).
[39] Crandall, John, Industrial Minerals Conference Discusses Garnet Abrasive: Eng. and Min. Jour., vol. 150, No. 6, June 1949, p. 90.
[40] Mining World, vol. 11, No. 8, July 1949, p. 62.

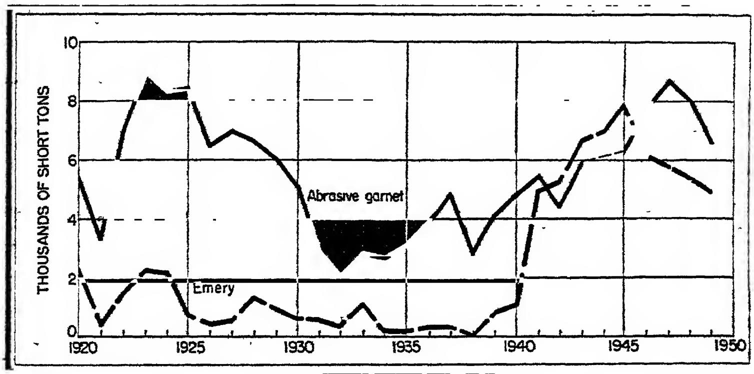

FIGURE 2.—Marketed production of abrasive garnet and domestic emery in the United States, 1920–49.

NATURAL ALUMINA ABRASIVES

Corundum.—Although reported output of corundum in the Union of South Africa, by far the chief world source of supply, was only 3 percent less in 1949 than in 1948, imports for consumption in the United States decreased sharply, totaling only 2,013 short tons in 1949. Difficulties in obtaining large enough shipments of material to meet minimum commercial demand in this country continued and did not allow any sizable increase in the National Stockpile. The United States Government and the American Abrasive Co. both have been attempting to obtain increased production in the Union of South Africa by stabilizing prices to the corundum diggers.[41] In the effort to augment present sources of supply, it is understood that negotiations have been initiated to buy corundum from French Cameroon, and further studies of marginal deposits in Mozambique and Nyasaland have been undertaken.[42] Geologic, geographic, and economic data regarding corundum deposits in the Union of South Africa and their exploitation were presented in a recent article.[43] The manufacture of synthetic corundum in Switzerland and a discussion of its uses were published.[44]

Prices on imported corundum are not quoted in the domestic trade press. Average value (foreign market value) of corundum ore imported in 1949 was $92.56, compared with $83.30 in 1948 and $80.87 in 1947. Quotations on natural corundum grain in 1949, as given in E&MJ Metal and Mineral Markets, remained at previous levels, as follows: Per pound, sizes 8 to 60, inclusive, 8¾ cents; 70–270, inclusive, 9¾ cents; 500, 30 cents; 850, 45 cents; 1,200–1,600, inclusive, 65 cents; and 2,600, 70 cents.

[41] South African Mining and Engineering Journal, Mining in the Northern Transvaal: Vol. 60, No. 2956, Oct. 8, 1949, p. 155.
[42] Engineering and Mining Journal, Washington Reflections—(ECA) Reviews Sources of Strategic Minerals: Vol. 150. No. 3. March 1949, p. 86.
[43] South African Mining and Engineering Journal, vol. 60, Part I, 1949, No. 2932, p. 243; Jour. Am. Ceram. Soc., vol. 32, No. 9, Sept. 1, 1949, p. 215 (abs.).
[44] Pough, Frederick H., Synthetic Corundum and Spinel Manufacturing in Switzerland: Jewelers' Circular-Keystone, vol. 119, No. 11, August 1949, pp. 136, 138, 182–189.

World production of corundum by countries, in metric tons, 1940–49 [1]

[Compiled by Helen L. Hunt]

Country [1]	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
Argentina					30	70	(2)	(2)	(2)	(2)
Australia (New South Wales)						[3] 10				
Belgian Congo					[4] 5					
Brazil					[5] 100	(2)	(2)	(2)	(2)	(2)
Canada [6]					157	1,195	673			
French Equatorial Africa					[5] 2	142	46	3		
India	(7)	56	135	110	349	409	97	84	284	(2)
Madagascar				14	70	50	21	1	4	(2)
Mozambique				834	1,108	152			(2)	(2)
Nyasaland		(7)	81	180	305	328	379			(2)
Southern Rhodesia	90	32	74	44			13		114	
Swaziland			15	141						
Tanganyika				7					(2)	(2)
Union of South Africa	3,820	6,119	6,724	4,270	3,531	4,379	1,854	2,313	2,537	2,464
United States (sales)				(8)	(8)					
Total (estimate) [1]	3,910	6,207	7,029	5,600	5,680	6,800	3,150	2,500	3,000	2,750

[1] In addition to countries listed, corundum probably is produced in U. S. S. R., but data on production are not available, and no estimate is included in the total.
[2] Data not available; estimate by author of the chapter included in total.
[3] Reported as corundum and emery (believed to be largely emery).
[4] Imports into the United States.
[5] Estimate.
[6] Recovered from tailing dumps.
[7] Less than 1 ton.
[8] Bureau of Mines not at liberty to publish figure, but total includes United States production as measured by sales.

Emery.—Production of emery for sale in 1949 decreased to 4,909 short tons valued at $60,917, or 9 percent less in quantity and 12 percent less in value than in 1948. These figures were the lowest in quantity and value, respectively, since 1941 and 1942. Producers of emery in 1949, as in other recent years, were Joe DeLuca and DiRubbo & Ellis, both of Peekskill, N. Y. Because of its marked resistance to wear, a large part of the output is used as a nonskid agent in concrete floors and steps. The balance is consumed for abrasive purposes, such as the manufacture of grinding wheels, abrasive sticks, and similar products. The sales since 1920 are presented graphically in figure 2. The experience of a saw-manufacturing company in using emery dust was reported.[45]

Emery sold or used by producers in the United States, 1944–49

Year	Short tons	Value	Year	Short tons	Value
1944	6,940	$64,858	1947	5,798	$66,927
1945	7,856	75,977	1948	5,405	69,408
1946	6,188	62,099	1949	4,909	60,917

As quoted in E&MJ Metal and Mineral Markets, the price of domestic first-grade emery ore, f. o. b. New York, was given as $12 per ton during both 1949 and 1948. Average value (foreign market value) of imported Turkish emery ore in 1949 was $13.42 per net ton, com-

[45] Cassels, C. S., Handling Emery Dust in Saw Glazing—Henry Disston & Sons, Inc.: Iron Age, vol. 164, No. 18, Nov. 3, 1949, pp. 94–95.

pared with $10.30 in 1948 and $16.34 in 1947. Grain emery in 1949 (f. o. b. Pennsylvania, in 350-pound kegs) was quoted in E&MJ Metal and Mineral Markets at 10 cents per pound for Turkish and Naxos grain and 6 cents per pound for American grain.

NATURAL CARBON ABRASIVES [46]

Industrial Diamonds.—The value of world sales of industrial diamonds in 1949 dropped 25 percent to £8,468,486 compared with the £11,300,000 sold in 1948, according to the Industrial Distributors (Sales), Ltd., London, the diamond-syndicate selling agency. Imports for consumption in the United States of bort, carbonados and ballas, and diamond dust in 1949 also showed large decreases in both quantity and value. The United States Government continued to make substantial purchases under its stockpiling program. The trend toward the use of smaller and cheaper diamonds in engineering, especially in multiset tools, was reflected in the lower average value of bort per carat of imports—1947, $3.27 per carat; 1948, $3.06; and 1949, $2.76. After devaluation of the pound sterling, prices of South African industrial diamonds were raised 30 percent for drilling stones and crushing bort, 25 percent for tool stones, and 20 percent for common goods.

A description of the building and an outline of the type of research carried forward at the new diamond research laboratory at Johannesburg, Union of South Africa, included a floor plan and a listing of the current projects under investigation. The latter include recovery, utilization, and fundamental research on physical properties of industrial stones and gems.[47] The uses of industrial diamonds in watch manufacture [48] and ceramics [49] in particular were reported.

The position of diamonds in the Union of South Africa and their importance in the general economy of the country were discussed briefly.[50] Gem stones rather than industrial diamonds have been the principal product of the diamond operations in that country. The opening of the Premier and New Jagersfontein pipe mines, scheduled for 1950, will increase the Union's production of good-quality industrials. Extensive mechanization, new equipment, and increased reserves of proved diamond-bearing areas were announced by the chief producer in the Belgian Congo,. the Société Miniére du Beceka.[51] The occurrence and development of the diamond deposits in British West Africa [52] and British East Africa [53] were described. Production, operating companies, and exports of diamonds from Gold Coast were

[46] *See also* Gem Stones chapter of this volume.
[47] Mine & Quarry Engineering, Diamond Research—the New Johannesburg Laboratory: Vol. 15, No. 4, April 1949, pp. 113–115.
[48] Gifford, H. P., Industrial Diamonds in Watch Manufacture: Guilds Newsletter, vol. 3, No. 5, 1948, pp. 3, 5, 8; Ind. Diamond Rev., vol. 8, No. 97, 1948, pp. 357–361 (abs.); Jour. Am. Ceram. Soc., vol. 32, No. 3, Mar. 1, 1949, p. 75.
[49] Chamberland, H. J., Diamonds in the Ceramic Industry: Ceram. Age, vol. 54, No. 2, August 1949, pp. 89–91.
[50] South African Mining and Engineering Journal, vol. 60, part 1, No. 2945, July 23, 1949, p. 677.
[51] Mining and Industrial Magazine of Southern Africa, Belgian Congo Diamonds: Vol. 39, No. 8, August 1949, p. 445.
[52] Junner, N. R., The Mineral Resources of the British West African Colonies: Min. Jour. (London), vol. 233, No. 5949, Aug. 27, 1949, p. 785.
[53] Teale, Sir Edmund O., The Mineral Resources of the East African Colonies: Min. Jour. (London), vol. 233, No. 5950, Sept. 3, 1949, p. 807.

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reported.[54] An interesting account of the discovery, history, and present development of the Diamond Corp. of America property near Murfreesboro, Ark., was published.[55] Another possible source of Arkansas diamonds has been located, according to the Arkansas State Geology Division.[56]

ARTIFICIAL ABRASIVES

The combined tonnage of silicon carbide, aluminum oxide, and metallic abrasives manufactured in 1949 decreased 18 percent in quantity and 24 percent in value compared with 1948. Production of aluminum oxide and shipments of metallic abrasives in 1949 each were substantially less than in the preceding year. On the other hand, production of silicon carbide rose 7 percent in quantity to its second highest year (only 3 percent below the peak year 1943) and topped by 2 percent the previous record realization (1943). The total for aluminum oxide in 1949 included 10,858 short tons of "white high-purity or special" material valued at $1,178,290, compared with 15,706 tons valued at $1,726,093 in 1948, a decrease of 31 percent in quantity and 32 percent in value. The estimated percentage of aluminum oxide used for refractory and other nonabrasive purposes in 1949 was 3 percent compared with 4 percent in 1948, while the similar figure for silicon carbide dropped to 24 percent in 1949 compared with 47 percent in 1948.

Crude artificial abrasives produced in the United States and Canada, 1945–49

Year	Silicon carbide [1]		Aluminum oxide [1] (abrasive grade)		Metallic abrasives [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	53,773	$4,238,665	147,016	$9,130,093	146,771	$8,524,073	347,560	$21,892,821
1946	63,849	5,457,903	132,084	8,367,158	111,512	6,387,819	307,445	20,212,880
1947	63,724	5,633,811	160,022	10,158,432	154,191	12,449,855	377,937	28,242,098
1948	63,033	5,874,731	154,972	10,279,583	147,218	15,174,773	365,223	31,329,087
1949	67,539	6,055,763	125,806	8,500,074	104,778	9,312,368	298,123	23,868,205

[1] Bureau of Mines not at liberty to publish data for United States separately. Figures include a small quantity used for refractories and other nonabrasive purposes.
[2] Shipments from United States plants only.

Stocks of metallic abrasives in 1949 increased slightly (2 percent); stocks of aluminum oxide were 45 percent higher than in 1948; and stocks of silicon carbide in 1949 more than quadrupled. There was an 11-percent increase in average annual capacity for silicon carbide production, a small rise in capacity for aluminum oxide, and a small decrease in capacity for metallic abrasives. The ratio of production to annual capacity was considerably lower in 1949, except for silicon carbide which was working at 83 percent of capacity, or only 3 percent less than in 1948. The ratios for aluminum oxide were 53 percent in 1949 and 66 percent in 1948 and for metallic abrasives were 46 percent in 1949 and 61 percent in 1948.

[54] Mining and Industrial Magazine of Southern Africa, Diamond Production in the Gold Coast: Vol. 39, No. 4, April 1949, p. 187.
[55] Wood, Junius B., America's 35 Acres of Diamonds: Nation's Business, vol. 37, No. 3, March 1949, pp. 60, 62–65.
[56] Engineering and Mining Journal, vol. 150, No. 9, September 1949, p. 120.

Stocks of crude artificial abrasives and capacity of manufacturing plants, as reported by producers in the United States and Canada, 1945–49, in short tons

Year	Silicon carbide		Aluminum oxide		Metallic abrasives [1]	
	Stocks, Dec. 31	Average annual capacity	Stocks, Dec. 31	Average annual capacity	Stocks, Dec. 31	Average annual capacity
1945	4,347	72,000	31,933	233,300	10,433	209,360
1946	5,339	71,679	27,072	232,889	6,524	211,407
1947	3,524	72,350	32,977	233,500	9,987	245,479
1948	5,387	73,250	34,177	233,500	9,907	240,129
1949	21,964	81,121	49,505	237,072	10,144	231,650

[1] Figures pertain to United States plants only.

Production of silicon carbide and aluminum oxide largely is concentrated in areas of plentiful and relatively inexpensive water power, especially in the Niagara Falls region of Canada and the United States and in Quebec; some aluminum oxide, however, is produced in Alabama. Two new silicon carbide plants under construction during 1948 were being operated in 1949—that of the Carborundum Co. at Vancouver, Wash., and that of the Electro Refractories & Alloys, Canada, Ltd., at Cap-de-la-Madelaine, near Three Rivers, Quebec, Canada. It was reported, also, that Norton Co., Worcester, Mass., has purchased a plant at Cap-de-la-Madelaine from Durham Chemicals, Ltd., for conversion to the manufacture of silicon carbide.[57]

Statistics of metallic abrasives include data for steel shot and grit but not steel wool, and pertain to shipments from United States plants only. The same firms reported sales in 1949 as in 1948 (18 companies with 19 plants). The three largest producing States again were Ohio, Michigan, and Pennsylvania. Metallic abrasives also were produced in 1949 in Illinois, Massachusetts, New Hampshire, and New York.

A description of the properties of aluminum oxide porous filter mediums was published.[58] The utilization of silicon carbide, aluminum oxide, and boron carbide in ceramics was described.[59] Cheap hydroelectric power and a growing market presage a sizable installation of artificial abrasives capacity in the Pacific Northwest region, according to a recent survey.[60]

MISCELLANEOUS MINERAL ABRASIVE MATERIALS

In addition to the natural and manufactured abrasive substances for which data are included herein, many other mineral materials are used for abrasive purposes. A number of oxides, including tin oxides, magnesia, iron oxides (rouge and crocus), cerium oxide,[61] chromium oxide, and manganese oxide, are employed as polishing agents. A zirconium silicate claimed to be useful for polishing optical glass has

[57] Moody's Industrials, 1949 Edition, p. 479; Chem. Eng., vol. 56, No. 3, March 1949, p. 248.
[58] Chemical and Engineering News, vol. 27, No. 25, June 20, 1949, p. 1809.
[59] Kraner, Hobart M., New Horizons in Ceramics: Ohio State Univ. Eng. Exp. Sta. News, vol. 21, No. 3, June 1949, pp. 39–40.
[60] Block, Ivan, Pacific Northwest—1960: Chem. Eng., vol. 56, No. 9, September 1949, p. 111.
[61] Davis, H. M., and Wayman, R. S., Manufacture of Ceria Polish: Canadian Chem. Process Ind., vol. 29, 1945, pp. 230–231; Jour. Am. Ceram. Soc., vol. 32, No. 8, August 1949, p. 193 (abs.).

been patented.[62] Also intended as a glass polishing medium is a recently patented abrasive made by calcining kaolin at about 2,200°F. in the presence of quicklime.[63] Certain carbides, such as boron carbide and the cemented carbides[64] which include tantalum carbide, titanium carbide, and tungsten carbide, have been used for their abrasive properties or because of their extreme hardness or durability. Other substances with abrasive applications include finely ground and calcined clays (ball clays, china clays, fire clays), lime, talc, ground feldspar, river silt, slate flour, and whiting.

FOREIGN TRADE[65]

Imports.—The total value of imports for consumption of both natural and artificial abrasives declined sharply in 1949 compared with 1948. Imports of diamond bort, carbonados and ballas, and diamond dust were substantially less than in 1948. Receipts of corundum ore and unground flint, flints, and flintstones decreased 44 and 33 percent, respectively. Imports of pumice increased somewhat, and emory ore and manufactured diamond bort showed large percentage gains over 1948, although they were considerably under 1947 levels. Imports of crude fused aluminum oxide in 1949 dropped 27 percent and silicon carbide 22 percent compared with 1948.

Exports.—The value of exports of natural and artificial abrasives in 1949 rose 14 percent compared with 1948. Due to a change in tariff classifications, it is not possible to show over a 5-year period data for items other than grindstones and pulpstones, diamond dust, and diamond grinding wheels. Exports of grindstones and pulpstones and diamond grinding wheels were smaller than in 1948, while diamond dust showed a moderate increase in caratage.

In 1949 the classification of "other natural, artificial, and metallic abrasives, manufactures and products" comprised natural abrasives and products valued at $4,072,648; manufactured or artificial abrasives and products valued at $9,056,436; manufactured grinding wheels except diamond wheels valued at $3,219,689; abrasive pastes, compounds, and cake valued at $97,059; and steel abrasives valued at $463,624. Exports of fused aluminum oxide and fused silicon carbide, crude and grain, in 1949 totaled 29,960 short tons valued at $3,880,078 and 6,315 tons valued at $2,056,813, respectively. Exports of abrasive paper and cloth of manufactured abrasives amounted to 70,882 reams valued at $2,248,615 compared with 89,609 reams valued at $1,534,398 of abrasive paper and cloth made of natural abrasives.

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[62] Maloney, W. T., Zirconium Silicate Polishing Material: United States Patent 2,427,799, Sept. 23, 1947 (appl. September 14, 1946); British Abs., August 1948, B–I, p. 402.

[63] Rock Products, vol. 52, No. 1, January 1949, p. 50.

[64] Schwartz, Arthur A., Carbides—the "Royalty" of Cutting Materials: Steel, vol. 113, No. 16, 1943, pp. 84–86; Jour. Am. Ceram. Soc., vol. 32, No. 4, Apr. 1, 1949, p. 97.

[65] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Abrasive materials (natural and artificial) imported for consumption in the United States, 1947–49, by kinds

[U. S. Department of Commerce]

Kind	1947		1948		1949	
	Quantity	Value	Quantity	Value	Quantity	Value
Burrstones: Bound up into millstones……short tons..	27	$1,848	1	$204	10	$897
Grindstones, finished or unfinished……short tons..	251	17,255	307	19,882	143	7,998
Hones, oilstones, and whetstones……short tons..	20	59,315	42	73,619	16	23,366
Corundum (including emery):						
Corundum ore..short tons..	2,401	194,158	3,612	300,865	2,013	186,328
Emery ore……do….	3,105	50,750	1,102	11,350	1,512	20,294
Grains, ground, pulverized, or refined……pounds..	114,493	4,516	125,041	4,809	5,143	594
Paper and cloth coated with emery or corundum reams..	1,356	180,584	[1] 1,368	180,743	718	88,044
Wheels, files, and other manufactures of emery or garnet……pounds..	3,294	4,326	4,963	6,504	15,217	17,101
Wheels of corundum or silicon carbide……pounds..	4,818	4,348	3,387	3,026	63	117
Garnet in grains, ground, etc. pounds..	1,264	190	3,101	578	------	------
Tripoli or rottenstone short tons..	83	2,951	------	------	(2)	808
Pumice:						
Crude or unmanufactured short tons..	7,809	70,174	8,475	85,370	8,843	79,804
Wholly or partly manufactured……short tons..	795	17,028	780	18,979	756	19,121
Manufactures, n. s. p. f……	------	148	------	------	------	694
Diamonds:						
Bort, manufactured carats..	1,679	95,975	613	69,024	1,060	79,950
Bort (glaziers' and engravers' diamonds, unset, and miners')……carats..	[1] 3,971,885	[1]12,997,032	[1]10,360,371	[1]31,738,956	6,256,485	17,281,774
Carbonado and ballas do….	27,234	315,636	[1] 60,836	[1] 842,429	5,204	57,445
Dust……do….	116,391	230,139	226,430	618,265	101,300	250,310
Flint, flints, and flintstones, unground……short tons..	11,399	280,407	11,193	269,935	7,554	165,290
Grit, shot, and sand, of iron and steel……pounds..	------	------	51,787	2,409	785,308	33,771
Artificial abrasives:						
Crude, n. s. p. f.:						
Carbides of silicon (Carborundum, Crystolon, Carbolon, and Electrolon)……pounds..	90,147,138	3,378,874	101,149,211	3,823,239	78,566,074	3,126,125
Aluminous abrasives, Alundum, Aloxite, Exolon, and Lionite…pounds..	247,480,349	6,879,188	247,426,381	7,010,348	179,502,573	4,849,980
Other……do….	203,360	6,369	498,838	18,407	883,297	27,884
Manufactures:						
Grains, ground, pulverized, refined, or manufactured……pounds..	66,169	3,698	207,410	32,220	139,090	15,241
Wheels, files, and other manufactures, n. s. p. f. pounds..	4,102	4,139	61,178	33,908	4,065	3,389
Total……	------	[1]24,799,048	------	[1]45,165,069	------	26,336,325

[1] Revised figure.
[2] Less than 1 ton.

Abrasive materials (natural and artificial) exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Grindstones and pulpstones		Diamond dust		Diamond grinding wheels		Other natural, artificial, and metallic abrasives, manufactures and products (value)	Total value
	Pounds	Value	Carats	Value	Pounds	Value		
1945	4,699,860	$252,293	92,019	$95,761	3,256	$83,626	$15,105,382	[1] $15,537,062
1946	6,135,719	285,799	116,650	146,490	4,398	95,205	13,908,147	[1] 14,435,641
1947	4,591,080	217,747	122,925	324,572	13,217	212,074	20,199,815	[1] 20,954,208
1948	2,887,995	131,725	52,600	80,352	11,562	270,929	14,784,664	[1] 15,267,670
1949	1,407,680	82,090	55,637	133,917	10,285	321,936	16,909,456	17,447,399

[1] Revised to include artificial and metallic abrasives, and manufactures.

Aluminum

By Richard H. Mote and Horace F. Kurtz

GENERAL SUMMARY

DOMESTIC primary aluminum output in 1949 decreased slightly from the record peacetime level established in 1948. Labor strikes closed three electrolytic reduction plants in the latter part of 1949 and were more responsible for offsetting the increased rate of production that characterized the beginning of the year than the chronic power shortages. Unlike most other industries, demand, which fell during spring and summer as a result of a general business recession and a lowering of inventories by aluminum consumers, had little effect on operation of most aluminum reduction plants. Secondary recovery added less to the supply of aluminum than in recent years.

Salient statistics of the aluminum industry, 1940–44 (average) and 1945–49

	1940–44 (average)	1945	1946	1947	1948	1949
Primary production short tons	546,616	495,060	409,630	571,750	623,456	603,462
Value	$162,971,000	$140,864,000	$115,812,000	$161,626,000	$180,755,000	$190,303,000
Quoted price per pound cents	16.0	15.0	15.0	15.0	15.7	17.0
Secondary production short tons	204,658	298,387	278,073	344,837	286,777	180,762
Imports	$23,655,011	$99,370,633	$12,463,960	$6,603,722	[1] $42,203,519	$36,815,965
Exports	$42,655,057	$9,906,041	$20,284,053	$52,231,972	[1] $43,219,940	$32,924,653
World production short tons	1,514,000	958,000	[1] 870,000	[1] 1,189,000	[1] 1,398,000	1,442,000

[1] Revised figure.

Apparent consumption of virgin aluminum declined 4 percent despite an increase to approximately 48,000 tons in net imports. As in all years since the conclusion of World War II, building products led the field of uses. Base prices of primary pig and ingot remained unchanged at 16 and 17 cents per pound, respectively, throughout 1949.

World production increased from an estimated 1,268,000 metric tons (revised figure) in 1948 to 1,308,000 tons in 1949. Output in Japan and Bizonal Germany gained substantially.

Aluminum ores, alumina, and aluminum salts are discussed in the Bauxite chapter of this volume.

PRODUCTION

Primary.—Domestic production of primary aluminum declined approximately 20,000 short tons to 603,462 tons in 1949. Aluminum output was high, however, compared with the over-all level of industrial production. The index of total production [1] dropped 8 percent

[1] Federal Reserve Bank indexes of physical volume of industrial production, 1935–39 equals 100.

from 192 in 1948 to 176 (preliminary) in 1949; but the index for aluminum production, calculated on the same base period, decreased from 498 to 482 or only about 3 percent. Because of the desirability of utilizing available power and maintaining optimum operating levels, production of pig aluminum at the reduction plants was not an immediate function of demand; on the other hand, special limiting factors, such as labor strikes and power curtailments, which did not affect most other industries, reduced output of aluminum in 1949.

Production of primary aluminum in the United States in 1949, by months

Month	Short tons	Month	Short tons	Month	Short tons
January	53,356	May	56,909	September	49,742
February	49,749	June	54,184	October	45,790
March	54,852	July	55,777	November	35,865
April	54,076	August	52,001	December	41,161

Primary production during each of the first 7 months of 1949 exceeded that in the corresponding month of 1948 and in May reached a monthly peak for the postwar period. Labor-management disputes, resulting in plant shut-downs, were the most significant factor adversely affecting production during the latter part of 1949. The first labor strike, beginning in August and terminating late in September, lasted 7 weeks and forced closure of Reynolds Metals Co. Hurricane Creek alumina plant and the Jones Mills facilities, both in Arkansas. A second strike, extending from October 17 to December 7, closed nine Aluminum Co. of America plants, including the huge reduction plant at Alcoa, Tenn., and a smaller operation at Badin, N. C. Power shortages in the Northwest also curtailed output during the final quarter of the year.

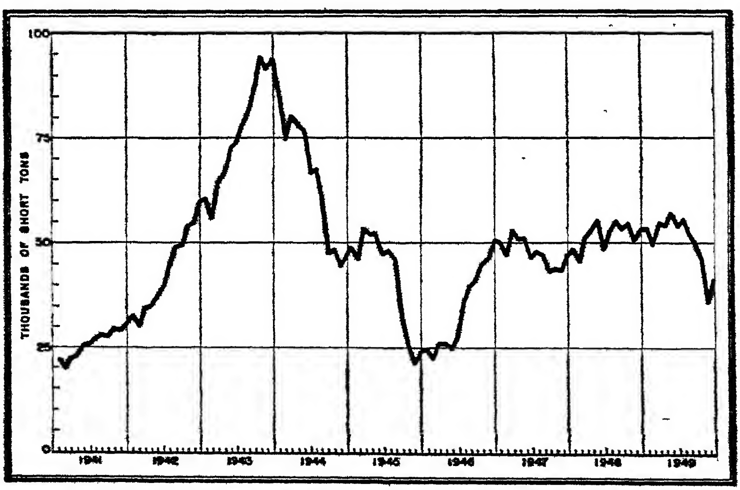

FIGURE 1.—Production of primary aluminum in United States, 1941–49. Data for 1941–July 1946 from War Production Board and Civilian Production Administration; thereafter, from reports to Bureau of Mines.

At the end of February, Aluminum Co. of America closed and dismantled its obsolete smelting plant at Niagara Falls, N. Y. Its new plant, with greater capacity, located at Point Comfort, near Port Lavaca, Tex., was nearly completed by the end of 1949. This plant, the first reduction plant constructed since the close of World War II, was described in the 1948 chapter of this series. Until the spring of 1949, Reynolds had operated only two pot lines or half the capacity of its plant at Jones Mills, Ark., owing to power shortage. Production from the third pot line was begun in April but was not resumed after the strike was settled. Both Reynolds and Aluminum Co. of America conducted surveys as to the feasibility of constructing facilities in British Columbia and Alaska, utilizing electrical energy from British Columbia where abundant potential water power is available.

Except for dismantling the Aluminum Co. of America plant at Niagara Falls, the productive capacity of the industry in 1949 was distributed among the producers unchanged since 1946. At the end of 1949, this company operated about 310,000 tons, or 49 percent of the total 630,000 tons operable rated annual reduction capacity; Reynolds, 190,000 tons or 30 percent; and Kaiser Aluminum & Chemical Corp., whose name was changed from Permanente Metals Corp., 130,000 tons or 21 percent.

The General Services Administration progressed further in 1949 with its program for disposal of Government-owned aluminum plants and facilities. Early in June, GSA announced the sale to Kaiser of the rod and bar mill at Newark, Ohio. Sale of the alumina plant in Baton Rouge, La., and the Mead reduction plant and Trentwood rolling mill in Spokane, Wash., in July completed transfer to private ownership of all surplus Government alumina and aluminum plants operated by Kaiser. In April, GSA sold the aluminum extrusion plant at Grand Rapids, Mich., to Reynolds. Five other plants, including the alumina plant at Hurricane Creek, Ark., the reduction plants at Jones Mills, Ark., and Troutdale, Oreg., the rolling mill at Chicago, Ill., and the extrusion plant at Phoenix, Ariz., were bought by Reynolds in December. Final sale of the Government-constructed St. Lawrence plant in New York to Alcoa was withheld through 1949 pending outcome of the United States Department of Justice monopoly charge in litigation against the company.

Although no new reduction plants were operated during 1949, primary producers expanded and improved facilities in other phases of production. Kaiser entered the foil industry by installing German machinery at its redesigned Permanente, Calif., plant and also added new rolling equipment at Trentwood and wire and cable facilities at Newark. Alcoa constructed a new plant at East St. Louis, Ill., for the production of fluoride chemicals, nearly completed a rod, wire, and cable mill at Vancouver, Wash., and began full operation of its Davenport, Iowa, sheet and plate rolling mill. A large expansion program was begun at Listerhill, Ala., by Reynolds to increase its capacity for producing foil, bar, rod, wire, and cable.

Shipments of aluminum wrought products and castings in 1949, as reported by the United States Department of Commerce, totaled 731,288 tons, compared with 1,032,303 tons the preceding year. Plate,

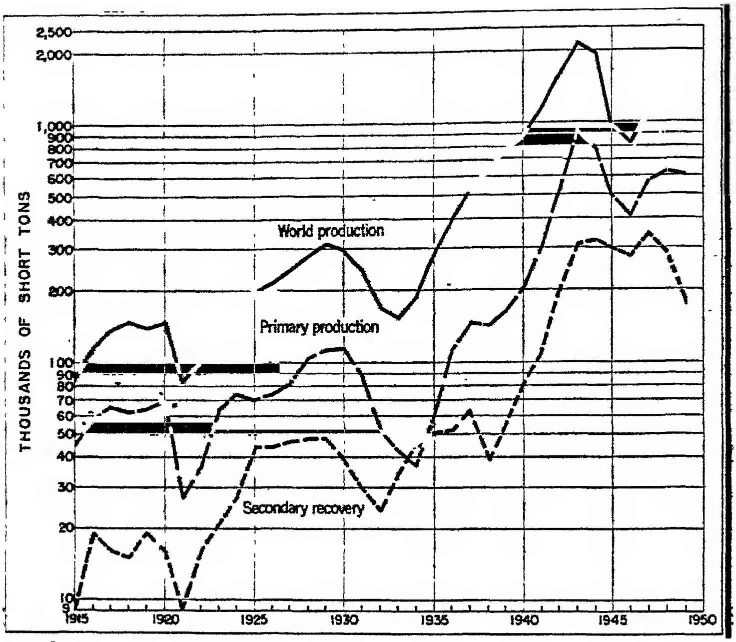

FIGURE 2.—Trends in world and domestic primary production and domestic secondary recovery of aluminum, 1915–49.

sheet, and strip comprised 68 percent of the 578,979 tons of wrought products, but rolled structural shapes, rod, bar, and wire was the only classification that increased in 1949. Of the 152,309 tons of castings reported shipped, 35 percent were sand castings, 34 percent permanent mold, 29 percent die, and 2 percent all other.

Secondary.—Recovery of 180,762 tons of aluminum derived from secondary material supplemented primary supplies in 1949 but was over 100,000 tons short of the 1948 total from this source. Secondary ingot prices, which where considerably higher than those for corresponding grades of primary ingot at the beginning of 1949, were sharply reduced by mid-summer and recovered only partly by the end of the year.

Detailed information regarding secondary aluminum in 1949 is given in the Secondary Metals—Nonferrous chapter of this volume.

CONSUMPTION AND USES

The apparent consumption of primary aluminum in 1949 totaled 635,956 tons, as computed by adding production and net imports and adjusting for producers' stock changes. This total was 4 percent less than the 665,875 tons (revised figure) used in 1948. However, as pointed out in the 1946 chapter of this series, the large importation and subsequent holding of Canadian aluminum by the Office of Metals Reserve greatly distorted apparent consumption from 1944 through 1948; and, for the purpose of presenting a truer picture of domestic

aluminum consumption, a modified set of figures was evolved, presented in the accompanying table, taking into account releases of Canadian aluminum from Reconstruction Finance Corporation inventories. This metal was completely disposed of by the end of 1948.

Apparent consumption of aluminum in the United States, 1940–44 (average) and 1945–49, in short tons

Year	Primary aluminum				Secondary aluminum recovered from old scrap	Total consumption
	Sold or used by producers	Imports (net)	Apparent consumption	Modified apparent consumption [1]		
1940–44 (average)	548,013	137	548,150	533,439	37,309	570,748
1945	468,836	328,216	797,052	696,750	27,311	724,061
1946	435,964	25,913	461,877	575,687	90,535	666,222
1947	570,923	[2] −46,694	[2] 524,229	[2] 571,789	163,847	[2] 735,636
1948	625,834	[2] 40,041	[2] 665,875	[2] 684,575	95,648	[2] 780,223
1949	587,532	48,424	635,956	635,956	44,596	680,552

[1] Apparent consumption modified by changes in stocks held by the Office of Metals Reserve.
[2] Revised figure.

Consumer demand for primary aluminum far exceeded the productive capacity of the industry during the early part of 1949. The huge backlog of orders for aluminum maintained relatively firm market conditions throughout most of the year's first quarter. Thereafter, as in the case of most other metals, demand fell rapidly, producers' stocks expanded, and metal shortages quickly disappeared. Consumers, aware of the growing availability of metal and fearing losses from possible market price declines, reduced inventories and canceled many previous orders, particularly on sheet aluminum. It should be noted that the beginning of this downward spiral in aluminum demand coincided with abandonment of plans for a 70-group air force. Market conditions reached a low point in midsummer, improved gradually thereafter, and were quite favorable for producers by the end of the year.

In 1949, building products led the field of aluminum consumption, a position that has been retained since the end of World War II. However, based on reports from the three producers of primary metal, most significant gains were made in uses for power transmission and transportation. Shipments of aluminum ingot and mill products by the Aluminum Co. of America in 1949 were distributed as follows (comparable 1948 figures in parentheses): Building products, 18 percent (18 percent); transportation (all forms), 18 (13); power transmission (conductors), 8 (6); household appliances, 7 (9); cooking utensils, 6 (9); machinery (general and electrical), 4 (4); shipments to fabricators for further processing, 25 (25); and all other uses, 14 (16).

The leading forms of consumption in building products in 1949 were insulated panels and corrugated roofing and siding sheet. A new type of aluminum curtain wall—aluminum panels backed by thin lightweight slabs—was introduced during the year. Wider diversification in construction products was evidenced by improvements and new developments in aluminum ceilings, window frames, chimneys, and

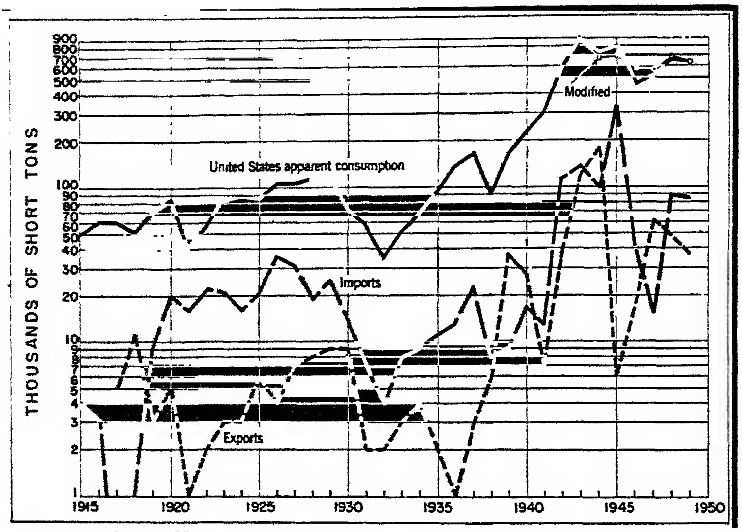

FIGURE 3.—Trends in imports, exports, and apparent consumption of aluminum, 1915–49.

bridges. Orders for over 25,000 aluminum grain bins for storing the Nation's large harvest provided a major outlet for aluminum.

A pronounced shift in the application of aluminum within the field of transportation developed, resulting from the expanded military aircraft procurement program. Whereas motor vehicles previously consumed about two-thirds, it was estimated that over half of the 1949 total for transportation was consumed in aircraft. Among the new aluminum products introduced were forged aluminum truck and trailer wheels and variations of extruded floor systems and other parts for these vehicles. Manufacturers have found motor-transport operators demanding weight saving, reduced maintenance, and other advantages accruing from the use of aluminum. Increased consumption in automobiles was also indicated by the increasing substitution of aluminum in a wide range of parts, chiefly castings. More aluminum was consumed in railroad tank cars in 1949 than in any other year, and new designs in certain passenger units also utilized large quantities.

A contract announced early in 1949 between Reynolds Metals Co. and the Wisconsin Electric Cooperative for the purchase of large quantities of power cable emphasized the growing importance of aluminum for use in electric transmission facilities. All leading producers of wire and cable progressed with plans for increasing production and thereby relieving the long continued shortage of conductor.

Consumption of aluminum foil for insulation and packaging expanded tremendously in 1949, and significant advances were also made in the use of irrigation pipe. Many other applications showed increasing importance, including such diverse products as paints, seamless cable sheathing, fasteners, tread plates, screens, tubing for heat exchangers, and television antennae. Late in the year, the Federal Power Commission approved the first experimental use of aluminum to replace steel in a gas pipeline.

STOCKS

Inventories of pig aluminum at reduction plants totaled 29,101 tons on December 31, 1949, compared with 13,171 tons at the end of 1948. From the end of June through October, however, stocks exceeded 45,000 tons or about 1 month's production. Data on consumers' inventories were not available.

On November 17, 1949, the Munitions Board added aluminum to the list of strategic materials to be stockpiled. No metal was purchased during 1949, but provisions were made to stockpile aluminum received from other Government agencies. In conjunction with this program, the General Services Administration agreed to accept aluminum from Reynolds Metals Co. and Kaiser Aluminum & Chemical Corp. toward payment for wartime aluminum production facilities which they have acquired. Funds advanced to Reynolds by the Economic Cooperation Administration for developing bauxite mining in Jamaica will also be repaid with aluminum.

PRICES

The base price of 30-pound 99-percent-plus virgin aluminum ingot remained throughout 1949 at 17 cents per pound, f. o. b. shipping point, the price established October 11, 1948. The price for primary pig was also unchanged at 16 cents a pound. An important factor in the astonishingly rapid acceptance of aluminum by many consumers over the past quarter of a century has been the downtrend of prices before World War II and their stability since October 1941. Since 1930, the two 1-cent increases in 1948, which were considered necessary to relieve the pressure of greatly increased costs, have been the only times base prices have risen, in contrast to widely fluctuating prices of most competitive materials. Slight readjustments in pricing some products of aluminum were made during 1949.

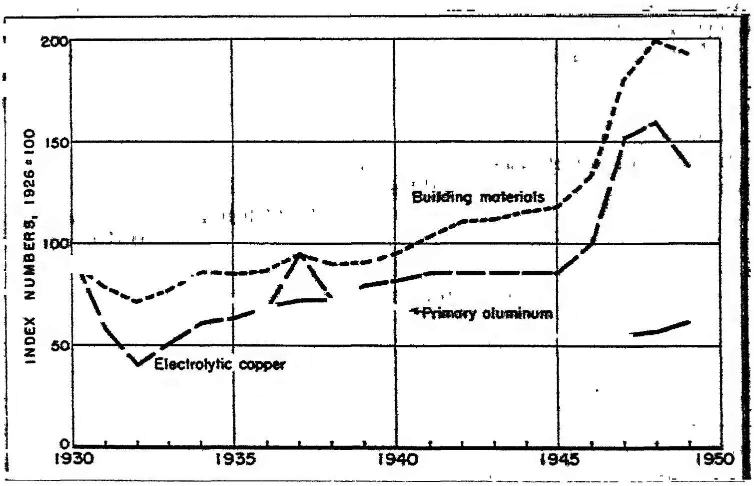

FIGURE 4.—Trends in average quoted prices of aluminum, copper, and building materials, 1930–49. Index numbers computed for electrolytic copper and primary aluminum, 99 percent pure, from prices reported by American Metal Market. Data for building materials from the Bureau of Labor Statistics.

TECHNOLOGY

Numerous technologic advances announced during 1949 pointed toward future expansion in aluminum consumption. In addition, new research laboratories were constructed by primary aluminum producers at East St. Louis, Ill., and Spokane, Wash. Among the many developments, a new general-purpose aluminum sheet alloy, 150S, appeared in the market. In the casting field, the successful production of a large, one-piece, inner door-frame aluminum die casting, to replace the multiple steel stamping and assembling operations formerly used, foretold wider use of aluminum in automobile bodies. A plaster casting process that would enable production of intricate aluminum castings with close tolerances and unusually high surface smoothness was also introduced.

Investigations[2] of three procedures for solid-phase bonding of aluminum alloys to steel were disclosed late in 1949. A new process for applying aluminum to steel to prevent corrosion was also developed. The procedure essentially consists of passing steel strip through an electrolytic bath, where it receives an iron coating, heating in a furnace to about 850° F., and finally rolling under high pressure between two strips of aluminum foil.

The many advancements in finishing and enameling brought forward during 1949 included development of a satisfactory vitreous enamel[3] for aluminum and its alloys. In the process, the frit-based enamel is furnace-fired on aluminum strips, sheetings, and castings.

FOREIGN TRADE[4]

Foreign trade in aluminum, as indicated by total values, declined approximately 18 percent in 1949. Net imports of metal (excluding scrap and manufactures) increased from 40,041 tons in 1948 to 48,424 tons in 1949. About 86 percent, or 72,892 tons, of the 1949 receipts came from Canada, predominantly in crude form, 5,851 tons from United Kingdom, 4,467 from Italy, 1,152 from Norway, and 844 from nine other European and two Asiatic countries. Shipments of sheets, plates, bars, etc., chiefly from United Kingdom, increased, reaching the highest level ever recorded (quantities of semicrude aluminum were first reported separately in 1921). Imports of aluminum-base scrap in 1949 totaled only slightly more than half those of the preceding year. Shipments from Germany, which replaced Canada as the leading source of foreign scrap, totaled 9,321 tons, and those from the United Kingdom 6,559 tons; the remaining 24,240 tons came from 36 other countries. The actual quantity of manufactures imported was not recorded, but their total value increased 79 percent over 1948. The tariff rates on aluminum in 1949 were as follows: Crude—2 cents per pound, scrap—1.5 cents per pound (duty suspended until June 30, 1949), and semifinished—3 cents per pound.

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[2] Journal of Metals, Aluminum Alloys to Steel: vol. 1, No. 11, November 1949, pp. 28–35.

[3] Materials and Methods, Vitreous Enameling Broadens Scope of Aluminum Applications: vol. 30, No. 5, November 1949, pp. 55–56.

[4] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Aluminum imported for consumption in the United States, 1947–49, by classes

[U. S. Department of Commerce]

Class	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Crude and semicrude:						
Metal and alloys, crude	[1] 15,608	[1] $3,728,065	83,164	$21,332,336	77,342	$21,569,460
Scrap	[1] 15,690	[1] 2,546,076	[1] 71,732	[1] 17,460,867	40,120	10,542,685
Plates, sheets, bars, etc	31	25,621	5,985	3,005,929	7,864	3,980,808
Total	31,329	6,299,762	[1] 160,881	[1] 41,799,132	125,326	36,092,953
Manufactures:						
Bronze powder and powdered foil	(2)	45	(2)	550	7	12,127
Foil less than 0.006 inch thick	41	70,058	18	29,049	197	188,308
Folding rules	(3)	11	(3)	5		
Leaf (5½ by 5½ inches)	(4)	50,608	(4)	74,485	(4)	29,527
Powder in leaf (5½ by 5½ inches)			(5)	114		
Table, kitchen, hospital utensils, etc	38	103,607	87	157,156	93	177,006
Other manufactures	(6)	79,631	(6)	143,028	(6)	316,044
Total	(6)	303,960	(6)	404,387	(6)	723,012
Grand total	(6)	6,603,722	(6)	[1] 42,203,519	(6)	36,815,965

[1] Revised figure.
[2] Less than 1 ton.
[3] Number: 1947, 26; 1948, 1; equivalent weight not recorded.
[4] Leaves: 1947, 7,566,959; 1948, 14,784,188; 1949, 5,585,064; equivalent weight not recorded.
[5] Leaves: 30,000; equivalent weight not recorded.
[6] Quantity not recorded.

Exports of aluminum (excluding scrap and manufactures) declined to 36,782 tons in 1949 from 49,108 tons (revised) in 1948. Shipments classified as ingots, slabs, and other forms of crude metal gained during 1949, but exports of plates, sheets, bars, etc., decreased for the second successive year. Crude aluminum was shipped to 23 countries; however, Germany received 4,602 tons or 57 percent of the total. Of the semicrude exported, 9,339 tons went to the Republic of the Philippines, 5,957 tons to Venezuela, and the remainder to 84 other countries. Although validated licenses were still required for shipments and applications were still screened, the Commerce Department removed export quota restrictions on aluminum plate, sheet, and strip for the third and fourth quarters of 1949. Only five countries purchased aluminum-base scrap from the United States during 1949: Haiti received most of the solids, and United Kingdom was the chief recipient of borings, turnings, and dross. The value of aluminum manufactures exported in 1949 declined 19 percent.

Aluminum exported from the United States, 1947–49, by classes

[U. S. Department of Commerce]

Class	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Crude and semicrude:						
Ingots, slabs, and crude	12,098	$3,578,029	1,239	$424,676	8,018	$3,169,680
Scrap	788	181,211	438	77,777	397	51,588
Plates, sheets, bars, etc	50,235	29,428,940	[1] 47,869	[1] 28,534,927	28,764	18,233,412
Total	63,121	33,188,180	[1] 49,546	[1] 29,037,380	37,179	21,454,680
Manufactures:						
Foil and leaf	4,860	4,611,598	1,976	1,566,315	1,462	1,205,492
Mill shapes	1,983	2,488,997	3,373	3,458,427	2,179	2,507,381
Powders and pastes (aluminum and aluminum bronze) (aluminum content)	737	709,446	474	444,967	366	380,439
Table, kitchen, and hospital utensils	2,624	4,469,291	1,376	2,432,637	925	1,673,619
Other manufactures	(2)	6,764,460	(2)	6,280,214	(2)	5,703,042
Total	(2)	19,043,792	(2)	14,182,560	(2)	11,469,973
Grand total	(2)	52,231,972	(2)	[1] 43,219,940	(2)	32,924,653

[1] Revised figure.
[2] Quantity not recorded.

WORLD REVIEW

World production of aluminum increased approximately 3 percent to 1,308,000 metric tons in 1949. Although output declined slightly in United States and Canada, which comprised two-thirds of the total, significant increases were recorded in Japan, Germany, Norway, Austria, and Switzerland.

World production of aluminum, by countries, 1943–49, in metric tons

[Compiled by Pauline Roberts]

	1943	1944	1945	1946	1947	1948	1949
Austria	44,201	40,097	5,250	1,032	4,544	13,319	[1] 17,000
Brazil			480				
Canada	449,734	419,176	195,691	175,449	271,302	333,007	332,799
China:							
Formosa	[2] 14,498	[2] 9,201	592			2,509	[3] 1,317
Manchuria	[3] 8,557	[3] 7,618	[1] 1,500				
France	46,462	26,154	37,225	47,952	53,395	64,785	59,900
Germany	203,068	191,000	[1] 20,000			[5] 7,306	[5] 23,975
Hungary	9,460	[6] 13,190	2,351	1,970	5,203	[1] 9,400	8,200
India	1,292	1,751	2,290	3,296	3,257	3,421	3,547
Italy	46,192	16,796	4,347	11,040	24,859	33,083	25,631
Japan	108,012	109,464	16,450	3,190	2,700	6,965	21,218
Korea	12,529	12,943	[7] 1,243	1,600	1,300	[1] 1,300	(4)
Norway	23,514	20,035	4,608	16,692	21,725	31,041	35,047
Spain	797	206	592	1,607	1,000	523	(4)
Sweden (includes alloys)	3,572	3,723	3,236	3,566	2,892	3,279	4,000
Switzerland	18,526	9,686	5,029	13,083	18,458	18,960	22,000
U. S. S. R.	62,340	[1] 71,000	86,310	[1] 105,000	[1] 120,000	[1] 140,000	(4)
United Kingdom	56,557	36,038	32,432	32,067	29,384	30,510	30,832
United States	834,768	704,376	449,109	371,608	518,680	565,587	547,449
Yugoslavia	[1] 2,000	[1] 1,000			600	2,900	(4)
Total [8]	1,946,000	1,693,000	869,000	789,000	1,079,000	1,268,000	1,308,000

[1] Estimated.
[2] Fiscal year ended Mar. 31 of year following that stated.
[3] January to October, inclusive.
[4] Data not available; estimate by authors of chapter included in total.
[5] Bizonal area.
[6] January to June, inclusive.
[7] April to June, inclusive.
[8] Preliminary figures.

Austria.—Power shortages in Austria continued to hamper production of aluminum by delaying reopening of the Ranshofen plant until April. However, greater allocation of power in the third quarter permitted operation of larger capacity than was originally proposed. Plans were under way for expanding fabrication facilities near this plant. Output from the smaller plant at Lend, which has its own power plant and was not subject to power restrictions, increased to over 5,000 tons. Austrian demand for aluminum was reported to have increased in 1949.

Canada.—Since conclusion of World War II, Canada has produced approximately one-quarter of the world's primary aluminum ingot. Low-cost hydroelectric power has enabled the Aluminium Co. of Canada, the only Canadian producer, to maintain a position as the leading supplier of metal on the international market, particularly for consumption in Great Britain and United States.

All five reduction plants, including the largest in the world at Arvida in the Saguenay Valley, are in the Province of Quebec. The Arvida, Isle Maline, and Shawinigan Falls plants provided all of the 1949 output; the La Tuque and Beauharnois plants have not operated since 1945. Drought conditions, with a resulting shortage of water for generating power, retarded operations in the first quarter of 1949, and in September portions of the Arvida and Shawinigan Falls plants were closed down because of unstable markets. Proposals were discussed for obtaining additional power for the Saguenay area from the Peribonka River.

Despite a 10-percent devaluation of the Canadian dollar in September, the price of aluminum ingot was unchanged at 15.5 cents per pound. In United States currency exchange this was equivalent to a price reduction of 1.5 cents and meant that Canadian ingot could be sold to the United States at 14 cents plus duty.

Preliminary surveys to establish huge power facilities for aluminum reduction in British Columbia were conducted by the Aluminium Co. of Canada in 1949. By the end of the year, the company had secured approval of a license to develop water power on the Nechako and Nanika Rivers. According to tentative plans, 1 million to 1.5 million horsepower could be developed. Two United States firms were also considering projects of nearly the same magnitude.

France.—The total capacity of French reduction works was rated at 95,000 metric tons, and plans for an additional 30,000 tons may be realized by 1953. All plants are located in either the Alps or Pyrenees and controlled largely by Pechiney but also Ugine interests. Before the last war, abundant bauxite and power in France had led to development of a nearly self-sufficient aluminum industry that normally exported large quantities of metal. Since then, power shortages have forced strict rationing from the nationalized power plants. Aluminum plants have operated at full capacity only during the summer, and these interruptions have resulted in high costs, despite excellent efficiency for most equipment.

Germany.—The governments of the three zones in Western Germany agreed to permit production of primary aluminum from plants totaling 85,000 metric tons theoretical capacity. It was decided to continue operations at Lünen, which was reactivated in 1949, reduce capac-

ity at Rheinfelden and Töging, and dismantle the Erftwerk Grevenbroich smelter. Although poor power conditions, low domestic demand, and large stocks of aluminum tended to limit production during 1949, output increased considerably over the previous postwar years. The price of German aluminum at the close of the year was quoted at D. M. 173 per 100 kilograms.

In the Russian Zone of Germany, only the plant at Bitterfeld was known to have operated in 1949, but reports indicated reopening of facilities at Lauta was being considered.

Hungary.—Planned aluminum production of 12,000 metric tons was not attained in Hungary, as output declined in 1949, owing largely to unavailability of low-cost electrical energy. Hungary has an abundance of bauxite, yet is forced to import cryolite and cheap anode material for reduction to aluminum. Development of the aluminum industry is aimed in three directions: Reducing cost by developing byproducts of alumina; improving aluminum fabrication technology; and expanding usage through substitution for scarce materials.

India.—In 1949 the Indian Parliament passed legislation to protect its two aluminum producers, Indian Aluminium Co. and Aluminium Corp. of India, through import duties and subsidies. Less than one-third of the 1949 demand was met by domestic producers, as labor strikes, lack of petroleum coke, and power restrictions prevented realization of expected output.

Italy.—Shortages of electricity in 1949 retarded production of aluminum in Italy, and exports were greatly reduced. The price of Italian ingot was quoted at 350 lire per kilogram at the close of the year.

Japan.—Production of aluminum in Japan increased threefold during 1949. Although occupational authorities limited actual output to 25,000 metric tons, an annual goal of 25,800 tons was envisioned. Under the proposed target, 14,500 tons were to be produced by Nippon Keikinzoku at Kambara, 6,000 tons by the Sumitomo company at Niihama, and 5,300 tons by Showa Denko at Kitakata. Japan's primary plants relied on bauxite from Indonesia and a domestic fabricating industry with a capacity in excess of the 1949 rate of reduction.

Norway.—With reactivation of facilities damaged during World War II, aluminum production in Norway has risen each year since 1945. Norwegian producers announced plans for increasing reduction capacity to surpass the record output of 1949. Production of a special high-grade aluminum, 99.996 percent pure, at the Vigeland plant was also reported.

Sweden.—Mainly to encourage construction of new primary capacity despite high-cost power, the Swedish Government decided to subsidize aluminum production up to 8,000 metric tons per year, equivalent to about half of domestic demand.

Switzerland.—Aluminum was produced at all four plants in Switzerland during 1949, but imports in bulk form gained slightly while exports declined. An unusual investment of foreign capital within the United States was disclosed by the announcement of Aluminum Foils, Inc., a wholly owned subsidiary of the Swiss Aluminum Co., of plans for erecting a new foil mill at Jackson, Tenn.

United Kingdom.—The aluminum-fabricating industry in United Kingdom, which grew extraordinarily during World War II, has maintained a surprisingly high level of activity since then. Total consumption of ingot in 1949 was approximately the same as in the foregoing year, notwithstanding variations in demand resulting from seasonal and price changes. Consumers experienced little difficulty in obtaining enough aluminum, mostly Canadian in origin, through the only buyer and seller, the Ministry of Supply. Reports that the Government was lowering dollar expenditures for Canadian aluminum were not substantiated by the volume of imports in 1949. Since the war, primary output by the only domestic producers, British Aluminium Co., and Northern Aluminium Co., has been consistently near 30,000 metric tons annually. A future shortage of ingot derived from British secondary sources was indicated by the rapid exhaustion of aircraft scrap.

Prices of 99- to 99.5-percent virgin aluminum ingot in United Kingdom advanced from £87 to £90 per long ton on April 1, and to £93 on August 15. Following devaluation of the British pound in the latter part of September, the price was adjusted to £112; but the increase did not equal the full devaluation, and the selling price of ingot in United Kingdom was brought closer to that of Canadian ingot. The extent to which the Ministry of Supply has had to equalize the high-cost British metal with the Canadian has been a subject of frequent speculation but has not been reported precisely. Chiefly resulting from tariff negotiations at Annecy, it was decided to abolish the 10-percent import duty on unwrought aluminum, effective January 1, 1950.

Yugoslavia.—Yugoslavia has undertaken to develop an aluminum industry to utilize its large production of bauxite. Construction of reduction plants at Strnisce and Mostar have been proposed, the former to be completed by 1951. The Lozovoc plant near Sibenik, built in 1937 with a capacity of 3,000 metric tons, was destroyed during the war. Rebuilt in 1946, the plant has since produced aluminum for the aviation, automobile, and can-manufacturing industries.

Antimony

By Samuel A. Gustavson and Mary E. Trought

GENERAL SUMMARY

A GENERAL business recession in the latter part of 1949 and consumer resistance to high prices of antimony resulted in a downward trend of the antimony industry from 1948. Decreases in the primary antimony industry were: Domestic mine output, 75 percent; domestic smelter production of metal, oxide, and sulfide, 43 percent; consumption, 25 percent; and industry stocks, 36 percent. Imports of ore, metal, and needle antimony decreased 45 percent. Secondary production was down 16 percent. Quoted prices for antimony in all forms recorded a general decline for the first time since price controls were removed November 9, 1946.

New supply of primary antimony available for consumption during 1949, in terms of recoverable metal,[1] was 11,947 short tons. A breakdown of this supply shows domestic antimony ores contributed 1,505 tons; domestic silver and lead ores 1,214 tons; imports for consumption 8,832 tons; and recovered from foreign lead ores 396 tons. The imported antimony arrived as follows: As metal 1,853 tons; recoverable in ores and concentrates 6,875 tons; in needle antimony 57 tons; and in oxide 47 tons. New supply from secondary sources was 18,061 tons.

Estimated total consumption of antimony in the United States in 1949 was 31,515 tons, comprising 13,454 tons in primary and 18,061 tons in secondary material.

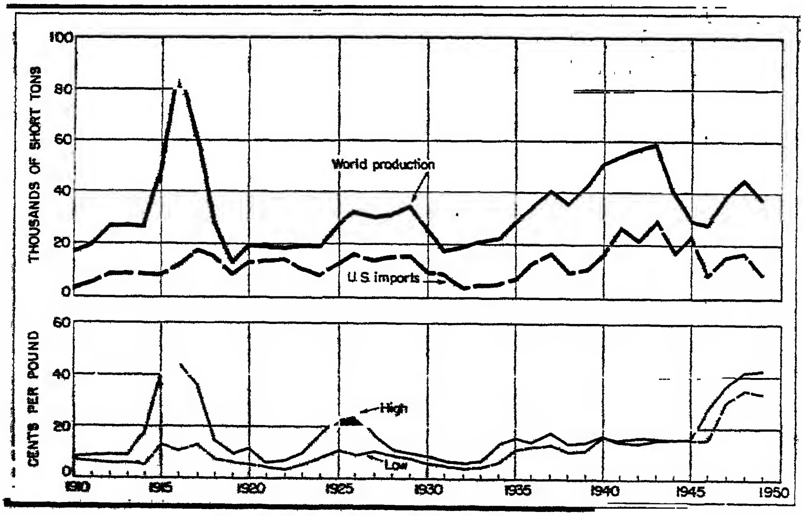

FIGURE 1.—Trends in world production, United States imports, and New York price of antimony, 1910–49.

[1] A factor of 92 percent of the content was used to determine quantity of metal recoverable from antimony ores and concentrates shipped to smelters.

Primary antimony consumed in the manufacture of finished products in 1949 totaled 11,844 tons. This figure includes losses of 314 tons in certain intermediate smelting and refining operations. There are no loss allowances, however, where antimonial materials are consumed in making finished products without intermediate processing in the United States, as when foreign metal or foreign or domestic ore is consumed.

In addition to the 11,844 tons accounted for above, 1,610 tons of primary antimony were recovered, chiefly as antimonial lead, from domestic and foreign silver and lead ores available for consumption. Consumption data for this material are not available. However, to obtain an estimated total consumption of primary antimony, this output should be added to bring the total primary antimony consumed in 1949 to 13,454 tons.

Secondary production and shipment of antimony recovered chiefly in lead base alloys at secondary plants, including antimony from scrap at primary lead refineries, was 18,061 tons.

War Production Board General Preference Order M-112, as amended, was revoked March 25, 1949.

Salient statistics for antimony in the United States, 1940–44 (average) and 1946–49

	1940–44 (average)	1946	1947	1948	1949
Production of primary antimony:					
Mine (antimony content) ... short tons	2,989	2,505	5,316	6,489	1,636
Smelter (antimony content) ... do	(1)	12,422	13,782	14,308	8,099
Production of secondary antimony ... do	16,524	19,115	22,984	21,592	18,061
Imports for consumption:					
Antimony in ore ... do	20,380	5,903	[2] 9,257	[2] 13,464	7,473
Needle or liquated antimony ... do	255	----------	17	533	81
Metal ... do	1,806	2,593	5,879	[2] 3,201	1,853
Exports of antimony ore and metal ... do	(1)	462	808	327	485
Consumption of primary antimony [3] ... do	(1)	17,515	16,647	15,455	11,530
Average price of antimony at New York: [4]					
Chinese (nominal) ... cents per pound	16.50	16.50	(1)	(1)	(1)
American ... do	[5] 15.06	17.31	33.45	36.67	38.73
World production [6] ... short tons	52,100	28,000	38,400	45,500	37,500

1 Data not available.
2 Revised figure.
3 Antimony recovered chiefly as antimonial lead at primary lead refineries from domestic and foreign silver and lead ore not included.
4 American Metal Market.
5 Arithmetical average.
6 Exclusive of U. S. S. R.

DOMESTIC PRODUCTION

MINE PRODUCTION

In 1949 shipments of antimony ores and concentrates totaled 5,260 short tons containing 1,636 tons of antimony, of which 1,505 tons are estimated as recoverable. In addition, 1,214 tons of antimony were recovered from silver or lead ores at primary lead refineries, chiefly as antimonial lead. Compared with 1948, the 1949 output of antimony from antimony ores and concentrates decreased 75 percent and from silver and lead ores 45 percent. The chief reasons for these decreases were lack of buying by consumers in resistance to high prices and reduced buying by dealers and refiners who wished to reduce their inventories of high-cost antimony.

Antimony-bearing ores and concentrates produced in the United States, 1940–44 (average) and 1945–49 in short tons

Year	Gross weight	Antimony content		Year	Gross weight	Antimony content	
		Quantity	Average percent			Quantity	Average percent
1940–44 (average)	8,370	2,969	35.7	1947	20,020	5,316	26.6
1945	14,966	1,930	12.9	1948	16,239	6,489	40.0
1946	13,962	2,505	17.9	1949	5,260	1,636	31.1

Alaska.—About 195 tons of ores averaging over 50 percent antimony were produced at four mines in Alaska in 1949, but only 74 tons containing 87,780 pounds were shipped, all by Earl Pilgrim from the Stampede mine in the Seward Peninsula.

Idaho.—Bradley Mining Co., the principal producer of antimony in the United States, ceased mining antimony ore April 1, 1949. The company began operation of its new smelter at Yellow Pine, Idaho, in 1949. Roasting units were started July 18 and the electric furnace, August 1. Hermada Mining Co. operated its mine in Elmore County. The ore is concentrated at the Tolache Mines, Inc., plant in Atlanta, Idaho. Concentrates produced in 1949 totaled 186 tons containing 223,200 pounds of antimony, of which 96 tons containing 115,200 pounds of antimony were shipped. Considerable antimony is recovered from silver ores produced by the Sunshine Mining Co., Shoshone County. This output is reported as antimony in antimonial lead produced at primary lead refineries. A small quantity of antimony was also recovered from silver ore shipped by Golden Age mine in Boise County.

Nevada.—Antimony ores containing a total of 108 tons of antimony were shipped from Nevada mines in 1949. The principal shippers were John M. Heizer and Ott F. Heizer, operating antimony mines in Pershing County. G. A. Peterson, operating the New Potosi mine in Mineral County, shipped 806 tons of lead ore averaging about 3.84 percent antimony to lead smelters at Midvale, Utah, and Selby, Calif. Recovery of antimony from this lead ore is shown in output of antimonial lead from primary lead refineries.

Other States.—Antimony ores containing a total of 6 tons of antimony were received at antimony smelters (from Oregon, 4 tons and Washington, 2 tons). No shipments of antimony ore were reported from mines in other States in 1949. Reports of investigations describing the Coyote Creek antimony deposits, Garfield County, Utah, and of Antimony Peak, Kern County, Calif. were published.[2]

SMELTER PRODUCTION

Primary.—Antimony smelters in the United States produced metal, oxide and sulfide containing a total of 8,099 short tons of antimony from domestic and foreign ores in 1949, a decrease of 43 percent from 1948. The Bureau of Mines is not at liberty to publish precise separate data on these three intermediate primary products. However,

[2] Traver, W. M., Investigation of Coyote Creek Antimony Deposits, Garfield County, Utah: Bureau of Mines Rept. of Investigations 4470, 1949. 18 pp.

ion of Antimony Peak, Kern County, Calif.: Bureau

about 60 percent of the output in 1949 was in the form of oxide, whereas over 50 percent of the output in 1948 was metal.

Antimonial lead produced as a byproduct by domestic primary lead refineries totaled 41,402 tons containing 3,385 tons of antimony in 1949, a decrease of 59 and 41 percent, respectively, from the 1948 output of 100,764 tons containing 5,760 tons of antimony. Mild winters in 1947 and 1948, which decreased demand for storage batteries, as well as general consumer resistance to high prices, were the chief factors causing the decrease. A detailed discussion of antimonial lead production is contained in the Lead chapter of this volume.

Secondary.—Antimony produced at secondary metal plants, including 1,775 tons recovered from scrap at primary lead refineries, was 18,061 short tons, a decrease of 16 percent from output in 1948. A detailed review is contained in the Secondary Metals—Nonferrous chapter of this volume.

Antimony metal, alloys, and compounds produced in the United States, 1940–44 (average) and 1945–49 in short tons

Year	Primary metal, oxide, and sulfide (antimony content)	Antimonial lead produced at primary lead refineries						Total secondary antimony (content of alloys)
		Gross weight	Antimony content					
			From domestic ores [1]	From foreign ores [2]	From scrap	Total		
						Quantity	Percent	
1940–44 (average)	([3])	48,636	2,101	548	955	3,604	7.4	16,524
1945	21,000	56,495	1,749	243	2,156	4,148	7.3	17,148
1946	12,422	50,480	1,231	226	1,828	3,285	6.5	19,115
1947	13,782	86,075	1,460	571	2,902	4,933	5.7	22,984
1948	14,308	100,764	2,190	1,031	2,539	5,760	5.7	21,592
1949	8,099	41,402	1,214	396	1,775	3,385	8.2	18,061

[1] Includes primary residues and small quantity of antimony ore.
[2] Includes foreign base bullion and small quantity of foreign antimony ore.
[3] Data not available.

CONSUMPTION AND USES

For the fourth consecutive year consumption of primary antimony decreased. Consumption in metallic products dropped 26 percent and in nonmetallic products, 24 percent in 1949 from that of 1948. The use of secondary material, chiefly in metallic products, decreased 16 percent.

Processing losses of primary antimony, in addition to quantities consumed as shown in the accompanying table, were reported by Office of Materials Distribution (OMD) and Office of Domestic Commerce, United States Department of Commerce (ODC), as 1,371 tons, 2,467 tons, 646 tons, 2,049 tons, and 1,657 tons, respectively, from 1944 through 1948, an average loss of 7.6 percent for the 5-year period. In 1949 processing losses were about 314 tons.

Industrial consumption of primary antimony, 1945–49, in short tons [1]

Product	1945	1946	1947	1948	1949
Metal products:					
Ammunition	107	30	24	21	6
Antimonial lead [2]	5,920	4,827	6,172	6,024	4,737
Battery metal	1,273	1,084			
Bearing metal and bearings	2,825	2,886	2,056	1,803	873
Cable covering	275	79	61	62	172
Castings	267	233	129	81	49
Collapsible tubes and foil	203	121	77	31	14
Sheet and pipe	368	218	225	195	306
Solder	125	281	132	145	155
Type metal	1,243	1,903	1,216	1,019	587
Total metal products	12,606	11,662	10,092	9,381	6,899
Nonmetal products:					
Ammunition primers	66	15	16	6	9
Antimony trichloride	207	106	(3)	(3)	(3)
Flameproofed textiles	7,675	97	205	388	422
Frits and ceramic enamels	936	1,814	1,754	1,561	1,155
Glass and pottery	304	351	421	352	296
Matches	18	25	23	37	28
Paints and lacquers	3,062	1,662	1,324	1,288	874
Plastics	(3)	(3)	[4] 156	228	349
Rubber	(3)	(3)	39	41	55
Sodium antimonate	512	1,358	(3)	(3)	(3)
Other	375	425	2,617	2,173	1,443
Total nonmetal products	13,155	5,853	6,555	6,074	4,631
Grand total	25,761	17,515	16,647	15,455	11,530

[1] Compiled from monthly applications filed with Office of Materials Distribution, U. S. Department of Commerce (formerly with War Production Board and Civilian Production Administration), 1945–48 Bureau of Mines, 1949.
[2] Includes miscellaneous metallic products.
[3] Included with "Other." Bureau of Mines not at liberty to publish separate figures.
[4] Consumption April through December 1947; January through March included with "Other."

STOCKS

Stocks of antimony raw materials were reduced in virtually all phases of the industry. Mine stocks of properties operated in 1949 (data on stocks of nonoperative mines are not available) decreased 756 tons from January 1 to December 31, and other industry stocks decreased 2,590 tons. All stocks of antimony held by the Office of Metals Reserve (OMR) on December 31, 1948, were disposed of during 1949, chiefly by transfer to the National Stockpile. The Bureau of Mines is not at liberty to publish data on stocks in the National Stockpile.

Stocks of antimony in the United States at end of year, 1948–49, in short tons of contained antimony

Raw material	Dec. 31, 1948 [1]				Dec. 31, 1949			
	Industry		OMR	Total	Industry		OMR	Total
	Mine	Other			Mine	Other		
Ore and concentrates	951	3,691	207	4,849	195	2,268	-------	2,463
Metallic antimony	-------	2,412	4,004	6,416	-------	1,587	-------	1,587
Antimony oxide	-------	2,160	-------	2,160	-------	1,915	-------	1,915
Antimony sulfide (needle and precipitate)	-------	205	-------	205	-------	108	-------	108
Total	951	8,468	4,211	13,630	195	5,878	-------	6,073

[1] Data for 1948 compiled by Office of Domestic Commerce, U. S. Department of Commerce.

PRICES

The price of domestic antimony metal in bulk, f. o. b. Laredo, Tex., was quoted at 38.5 cents per pound from October 8, 1948, to October 7, 1949, then 32 cents per pound to the end of the year. For purposes of calculating the value of antimony, the 1949 average New York equivalent of the Laredo price published by American Metal Market is used in this chapter except for imports and exports. The New York price is about 1.78 cents a pound higher than the Laredo quotation, and the average quoted for 1949 was 38.73 cents. In 1948 the average New York price was 36.67 cents. The price for Chinese antimony per pound, min. 99 percent, in cases f. o. b. New York, duty paid, was considerably less than that for domestic metal most of the year. Opening quotations and changes published by E&MJ Metal and Mineral Markets, in cents per pound, follow: January 1, nominal; January 20, 38.5; March 10, 38–38.5; April 21, 38; May 5, 36–38; July 14, 34–36; July 21, 36–38; August 4, 34–36; August 18, 32–34; October 13, 27–28; and October 27, 26.

Year opening and changes in nominal quotations, according to E&MJ Metal and Mineral Markets, for antimony ore per unit (20 pounds) of antimony contained were as follows:

	50–55 percent	*58–60 percent*	*60–65 percent*
January 1	\$5. 00–\$5. 10	\$5. 10–\$5. 20	\$5. 20–\$5. 30
May 5	4. 80– 4. 90	4. 90– 5. 00	5. 00– 5. 10
July 21	4. 00– 4. 50	4. 40– 4. 50	4. 50– 4. 60
August 4	3. 80– 4. 10	4. 10– 4. 30	4. 30– 4. 40
September 15	3. 60– 3. 80	3. 90– 4. 00	4. 10– 4. 20
September 29	3. 60– 3. 80	3. 90– 4. 00	4. 00– 4. 10
October 13	3. 40– 3. 50	3. 50– 3. 60	3. 60– 3. 80
December 8	2. 80– 2. 90	2. 90– 3. 00	3. 00– 3. 20
December 15	2. 70– 2. 80	2. 80– 2. 90	2. 90– 3. 00

FOREIGN TRADE [3]

Imports.—General imports of antimony in antimony ore, metal, and needle or liquated antimony decreased 44, 42, and 85 percent, respectively, from those of 1948. The general decrease in imports was due chiefly to the small consumer demand. Imports of ore and concentrates came principally from Mexico, Bolivia, Peru, and Chile (material imported from Chile was probably mined in Bolivia or Peru). Imports of metal were chiefly from Mexico, Yugoslavia, Belgium-Luxembourg, and China. The needle antimony was from China. In addition to the imports for consumption shown in the accompanying table, 56 short tons (gross weight) of antimony oxide valued at \$27,290 were imported from the United Kingdom (11 tons) and Belgium (45 tons) in 1949.

[3] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Antimony imported for consumption in the United States, 1940–44 (average) and 1945–49

[U. S. Department of Commerce]

Year	Antimony ore			Needle or liquated antimony		Antimony metal		Type metal and antimonial lead [1] (short tons)
	Short tons	Antimony content		Short tons (gross weight)	Value	Short tons	Value	
		Short tons	Value					
1940–44 average	46,945	20,380	$3,354,206	255	$49,364	1,806	$501,843	219
1945	49,385	22,643	4,644,859			627	181,557	1,380
1946	19,741	5,903	1,323,903			2,593	824,698	246
1947	[2] 28,471	[2] 9,257	[2] 2,672,249	17	7,914	5,879	3,487,126	187
1948	[2] 41,610	[2] 13,464	[2] 4,312,431	533	314,809	[2] 3,201	[2] 2,022,676	[2] 1,569
1949	17,855	7,473	2,488,271	81	42,537	1,853	1,242,582	654

[1] Estimated antimony content; for gross weight and value, see Lead chapter of this volume.
[2] Revised figure.

Antimony imported into the United States, 1945–49, by countries [1]

[U. S. Department of Commerce]

Country	Antimony ore			Needle or liquated antimony		Antimony metal	
	Gross weight (short tons)	Antimony content		Short tons (gross weight)	Value	Short tons	Value
		Short tons	Value				
1945	49,543	22,736	$4,641,036			627	$181,557
1946	19,744	5,905	1,324,117			2,593	824,698
1947	28,536	9,287	2,678,530	17	$7,914	5,899	3,499,947
1948							
Belgium-Luxembourg						[2] 212	[2] 147,928
Bolivia [3]	[2] 5,374	[2] 3,416	[2] 1,519,365				
Canada	98	31	3,833			1	387
Chile [3]	[2] 157	[2] 108	[2] 43,674				
China				533	314,809	[2] 2,860	[2] 1,792,527
French Morocco	171	95	45,499				
Honduras	10	6	2,612				
Italy						30	19,837
Mexico	33,726	8,674	2,173,935			54	36,045
Peru [3]	1,939	1,062	497,068				
Portugal	26	17	7,318				
Thailand	109	55	19,127			3	1,619
Yugoslavia						[2] 157	[2] 98,230
Total	[2] 41,610	[2] 13,464	[2] 4,312,431	533	314,809	[2] 3,317	[2] 2,096,573
1949							
Belgium-Luxembourg						384	254,033
Bolivia [3]	4,845	3,153	1,287,540				
Canada	164	49	13,265			11	6,578
Chile [3]	814	544	243,817				
China				81	42,537	313	201,584
Honduras	16	8	4,725				
Italy						44	28,550
Mexico	10,527	2,985	677,795			768	564,202
Netherlands						11	8,136
Peru [3]	1,478	727	258,129				
Portugal	11	7	3,000				
United Kingdom						78	40,365
Yugoslavia						472	264,272
Total	17,855	7,473	2,488,271	81	42,537	2,081	1,367,720

[1] Data include antimonyi mported for consumption, plus material entering the country under bond.
[2] Revised figure.
[3] Imports shown from Chile probably were mined in Bolivia or Peru and shipped from a port in Chile.

Exports.—Exports in 1949 (gross weight) of antimony ore and concentrates were 35 short tons valued at $10,984; metal and alloys, 450 tons valued at $337,177; and salts and compounds, 223 tons valued at $151,932. During 1948, exports (gross weight) included 69 short tons of antimony ore and concentrates valued at $29,727 and 258 tons of metal and alloys valued at $181,070. Data on exports of compounds were not available for 1946–48. Reexports of ore and concentrates in 1949 were 27 tons valued at $8,557. There were no transactions in metal and alloys. During 1948, reexports of foreign ore and concentrates were 204 short tons valued at $66,371 and of foreign metal and alloys 390 pounds valued at $105.

Foreign antimony (regulus or metal) exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1945	463	$141,301	1948	(1)	$105
1946	139	43,197	1949	-------------	----------
1947	40	19,341			

[1] 390 pounds.

WORLD REVIEW

World production of antimony in recent years, insofar as data are available, is shown in the accompanying table. Decreases in output in 1949 of most of the countries supplying the United States can be attributed to lack of consumer demand in the United States. Exceptions are Yugoslavia, where an increase was reported, and China, where production was interrupted by war.

Canada.—Antimony output in 1949 was 50 percent less than in 1948. Imports of antimony regulus increased from 1,093,835 pounds in 1948 to 2,583,635 pounds in 1949. Most of the 1949 imports were from China, followed by the United States, Belgium, and the United Kingdom.

China.—Imports of antimony into Hong Kong in 1949 were 1,986 metric tons—1,535 from south China, 449 from north China, and 2 from Macao. Exports from Hong Kong during the year were 1,347 tons, Germany being shipped 608 tons, Canada 500, the U. S. S. R. 200, the United States 35, and Thailand and the Philippines the remainder. Hunan Province, in which lie China's principal antimony deposits, fell to the Chinese Communists in December 1949.

French Morocco.—A description of the antimony deposits in Morocco appeared in Echo des mines et de la métallurgie.[4]

Germany (Soviet Zone).—The Oberboehmsdorf mine, by a new process, produced the first antimony metal in the Soviet Zone in 1949. Antimony ore formerly was sent to Czechoslovakia for treatment.

Japan.—Nihon Seiko (Japan Concentrate) Co., owner of the Nakase mine, completed and began operation of an antimony smelter at Sekinoyamura, Hyogo Prefecture, in October 1948. The mine is said to contain 1,000,000 tons of probable ore averaging 30 grams of silver and 5 grams of gold per ton and 1 percent antimony. It was the only antimony producer in 1949.

[4] Echo des mines et de la métallurgie, Paris, Les Gisements d'antimoine au Maroc: No. 3416, January 1950

World production of recoverable antimony, by countries, 1941–49, in metric tons [1]

[Compiled by Berenice B. Mitchell]

Country	1941	1942	1943	1944	1945	1946	1947	1948	1949
North America:									
Canada [2]	1,329	1,269	465	809	696	268	442	129	64
Honduras	23	103	110	65	11	8	-	5	8
Mexico [2]	10,241	10,759	12,585	10,056	8,053	6,046	6,371	6,790	5,293
United States	1,013	2,457	4,638	3,952	1,611	2,091	4,437	5,416	1,365
South America:									
Argentina	123	41	100	71	13	-	-	-	-
Bolivia (exports)	13,680	16,231	16,536	6,852	5,093	6,407	9,989	11,280	9,453
Peru	1,440	1,457	2,472	932	2,041	969	1,140	1,470	750
Europe:									
Austria	26	391	571	658	132	15	82	[3] 247	[3] 349
Czechoslovakia	1,645	[4] 3,130	(5)	(5)	1,115	2,156	1,434	1,600	(5)
France	-	128	153	116	153	202	200	(5)	(5)
Hungary [4]	3,000	2,200	1,500	[6,7] 1,160	-	-	-	(5)	(5)
Italy	819	667	522	403	348	371	472	420	330
Portugal	46	135	[4] 115	[4] 39	3	3	23	38	(5)
Spain	101	210	176	128	108	96	84	132	150
Asia:									
Burma [4]	400	843	843	843	843	-	40	110	(5)
China	[8] 7,989	[8] 3,510	[8] 505	[8] 203	-	426	1,909	3,251	(5)
French Indochina	4	1	11	23	-	-	-	-	-
Iran [9]	19	(5)	18	2	-	-	(5)	(5)	(5)
Japan	250	350	600	450	210	49	100	124	158
Thailand	-	-	[4] 22	[4] 54	[4] 41	-	[4] 104	85	213
Turkey (Asia Minor)	80	40	8	58	33	36	103	520	420
Africa:									
Algeria	397	304	902	170	423	-	120	787	1,288
French Morocco	184	322	409	166	353	260	265	411	600
Southern Rhodesia	83	169	164	116	29	15	76	8	34
Spanish Morocco	85	144	153	72	52	103	128	240	150
Union of South Africa	445	990	1,560	2,570	2,250	2,330	3,020	3,780	4,100
Oceania:									
Australia	1,052	1,042	532	454	172	496	160	170	[10] 40
New Zealand	8	-	-	-	-	-	-	4	(5)
Total (except U. S. S. R.) [11]	49,000	51,400	53,200	36,400	26,900	25,400	34,800	41,300	34,000

[1] Approximate recoverable metal content of ore produced, exclusive of antimonial lead ores; 92 percent of reported gross content is used as basis for calculations in nearly every instance. U. S. S. R. and Yugoslavia produce antimony, but data on production are not available; an estimate for Yugoslavia is included in the total.
[2] Includes antimony content of antimonial lead.
[3] Excludes Soviet Zone, data for which are not available.
[4] Estimate.
[5] Data not available; estimate included in total.
[6] January to June, inclusive.
[7] Data represent Trianon Hungary after October 1944.
[8] Data represent area designated as Free China during the period of Japanese occupation.
[9] Fiscal year ended March 20 of year following that stated.
[10] Excluding New South Wales; data not available.
[11] Estimated by senior author of chapter.

Mexico.—The decline in production of antimony from 6,790 metric tons in 1948 to 5,293 tons in 1949 was due largely to curtailed output by the National Lead Co. because of the prevailing low consumer demand in the United States. Additional equipment installed at the Monterrey lead refinery of American Smelting & Refining Co. will increase its metallic antimony capacity to 250 tons a month, almost double the previous capacity. An antimony deposit is reported to have been located in the Sierra de Coronado Mountains in San Luis Potosi State, 7 miles from a railroad.

United Kingdom.—Imports of recoverable antimony in ores and concentrates declined 12 percent in 1949. Imports of antimony metal were negligible. Consumption of antimony metal and compounds also declined 12 percent, whereas scrap consumption was only 5 percent less and represented 44 percent of total consumption.

Arsenic

By Jack W. Clark

GENERAL SUMMARY

THE STRONG trend in consumer preference for organic insecticides over arsenicals continued unabated in 1949 and, coupled with more ready availability of the organics at reduced prices, brought the domestic white arsenic industry to a near-impasse. Producers of

Historical salient statistics for white arsenic in the United States, 1910–49, in short tons

Year	Production [1]	Sales	Imports	Exports [2]	Apparent consumption [3]	Producers' stocks	Prices per pound [4]
1910	1,497	(5)	1,348		2,845	(5)	$0.02¼-$0.03¼
1911	3,132	(5)	1,921		5,053	(5)	.03
1912	3,141	(5)	3,103		6,244	(5)	.03½
1913	2,513	(5)	1,519		4,032	(5)	.04⅜
1914	4,670	(5)	1,594		6,264	(5)	.03¾
1915	5,498	(5)	1,400		6,898	(5)	.03½-.04½
1916	5,986	(5)	1,071		7,057	(5)	.03⅞-.08¼
1917	6,151	6,151	1,178		7,329	(5)	.08-.20
1918	6,323	6,323	1,847		8,170	(5)	.09-.15
1919	6,029	6,029	4,389		10,418	(5)	.08-.12
1920	11,502	11,502	3,740		15,242	(5)	.10¼-.18
1921	6,158	4,786	1,669		6,455	(5)	.05¾-.09½
1922	9,350	10,027	1,081		11,108	(5)	.06-.15½
1923	14,902	14,271	10,152	(5)	24,423	(5)	.09-.15½
1924	20,177	14,453	8,877	(5)	23,330	(5)	.13½-.06½
1925	12,119	12,317	9,316	(5)	21,633	(5)	.06¼-.03½
1926	6,759	11,805	7,703	(5)	19,508	(5)	.03-.03½
1927	11,730	11,560	12,517	(5)	24,077	(5)	.03½-.04
1928	14,163	11,767	11,153	(5)	22,920	(5)	.04
1929	16,605	14,546	13,157	(5)	27,703	(5)	.04
1930	17,057	17,425	10,471	(5)	27,896	(5)	.04
1931	17,137	13,777	7,791	1,400	20,168	(5)	.04
1932	12,704	12,483	6,882	2,000	17,365	(5)	.04
1933	10,650	11,797	10,583	2,000	20,380	(5)	.04
1934	13,096	15,623	14,110	2,700	27,033	(5)	.03½-.04
1935	14,237	12,670	15,075	800	26,945	(5)	.03½
1936	15,379	15,581	17,586	1,000	32,167	(5)	.03½
1937	16,814	17,636	19,256	2,200	34,692	(5)	.03½-.03
1938	16,685	13,169	14,238	2,300	25,098	(5)	.03
1939	22,341	22,439	14,674	3,200	33,913	5,505	.03
1940	24,983	23,339	9,929	1,639	31,629	6,944	.03-.03½
1941	32,481	34,784	10,292	1,616	[6] 43,460	4,518	.03-.04
1942	28,681	31,038	16,350	305	[6] 47,083	[7] 2,187	.04
1943	31,202	32,423	16,112	1,975	[6] 46,560	[7] 1,138	.04
1944	36,094	34,472	9,965	2,401	[6] 42,036	[7] 2,760	.04
1945	24,349	24,810	13,149	858	37,101	[7] 2,299	.04
1946	10,211	12,039	[8] 13,821	[9] 1,000	24,860	471	.04-.06
1947	18,755	18,188	13,940	[9] 1,000	31,128	1,038	.06
1948	[8] 18,639	[8] 14,965	9,336		24,301	4,712	.06-.06¼
1949	12,795	10,181	4,696		14,877	7,326	.06-.05½

[1] For years before 1910, see Mineral Resources of the United States, 1919, pt. 1, p. 19.
[2] Figures for 1943–45 reported by U. S. Department of Commerce; figures for all other years reported by producers to Bureau of Mines.
[3] Producers' shipments, plus imports minus exports.
[4] Refined white arsenic, carlots, as quoted by Oil, Paint and Drug Reporter.
[5] Data not available.
[6] Consumption based on allocation data of the War Production Board was 40,442 tons in 1941, 41,520 tons in 1942, 51,083 tons in 1943, and 43,509 tons in 1944.
[7] Excludes Government stocks as follows: 1942, 2,693 short tons; 1943, 1,018; 1944, 3,029; 1945, 1,987.
[8] Corrected figure.
[9] Conjectural.

arsenical insecticides ordinarily consume the bulk of the output of white arsenic. The seriousness of the situation was amply evidenced by markedly lowered apparent consumption and imports of white arsenic, both of which plunged to the lowest levels since 1922. No exports were reported by producers. Producers' stocks were the highest on record; and output of white arsenic reached the lowest point since 1933, with the exception of the strike-ridden year 1946.

DOMESTIC PRODUCTION

Crude and refined white arsenic was produced in 1949 by the Anaconda Copper Mining Co., at Anaconda, Mont. (copper smelter); United States Smelting, Refining & Mining Co., at Midvale, Utah (lead smelter); and American Smelting & Refining Co., in plants at Tacoma, Wash. (copper smelter), El Paso, Tex. (copper and lead smelter), and Murray, Utah (lead smelter). The Murray smelter was shut down on October 1, 1949, as a result of a long-continued shortage of ore and other economic factors. Arsenic metal was produced by Anaconda Copper Mining Co., 1949 output falling about 35 percent below 1948. Arsenical cobalt-nickel concentrates from Canada continued to be processed by Shepherd Chemical Co., Cincinnati, Ohio, for the preparation of sodium arsenite solution.

During 1949 Getchell Mine, Inc., operating in the Potosi district, Humboldt County, Nev., essentially completed construction of a new mill designed to treat 1,500 tons of arsenical gold ore per day. The arsenic is present in the minerals realgar, orpiment, and arsenopyrite. The realgar and orpiment will be removed by flotation and, being gold-free, will be stock-piled as such. It is estimated that daily production of realgar-orpiment concentrates will total 30 to 60 tons. Jardine Mining Co., Jardine, Mont., which had been mining high-arsenic gold-tungsten ores, suspended operations in August 1948.

Production and shipments of white arsenic by United States producers, 1940–44 (average), and 1945–49

Year	Crude			Refined			Total		
	Production (short tons) [1]	Shipments		Production (short tons)	Shipments		Production (short tons)	Shipments	
		Short tons	Value [2]		Short tons	Value [2]		Short tons	Value [2]
1940–44 (average)	25,638	26,015	$1,006,262	5,050	5,196	$245,240	30,688	31,211	$1,251,502
1945	21,358	22,180	1,041,614	2,991	2,630	155,447	24,349	24,810	1,197,061
1946	8,981	10,448	557,986	1,230	1,591	97,091	10,211	12,039	655,077
1947	17,636	17,119	1,424,316	1,119	1,069	109,440	18,755	18,188	1,533,756
1948 [3]	17,213	13,749	1,141,213	1,426	1,216	119,054	18,639	14,965	1,260,267
1949	12,289	9,597	713,984	506	584	50,527	12,795	10,181	764,511

[1] Excludes crude consumed in making refined. Includes crude white arsenic equivalent of compounds made directly from ores, flue dust, and speiss as follows: 1945, 112 tons; 1946, 180; 1947, 97; 1948, 88; 1949, 26.
[2] Partly estimated.
[3] Revised figures.

CONSUMPTION AND USES

White arsenic is consumed principally in making calcium and lead arsenate. Most of the calcium salt is employed for controlling cotton insects, the lead compound being used largely by apple growers to combat codling moths. Production of both calcium and lead arsenate

is usually closely related to the anticipated near-term requirements of agricultural consumers.

Apparent consumption of white arsenic in 1949 dropped 39 percent below the previous year, despite the fact that cotton acreage was the highest since 1937, cotton insect infestation was of near-record proportions, and unusually wet weather necessitated repeated crop-dustings. More ready availability and lowered prices of preferred organic insecticides—chiefly benzene hexachloride, toxaphene, and chlordane—were the chief factors responsible for the accelerated trend away from arsenicals. DDT (dichloro-diphenyl-trichloroethane) continued to displace lead arsenate to a large extent in the apple industry, reportedly being lower in cost, more generally effective, and less of a problem in meeting tolerance requirements for spray residue. Additional production facilities for organic insecticides were completed in 1949 and still others were under construction.

Arsenic in various forms continues to be consumed in producing glass, wood preservatives, acid inhibitors, poisoned baits, and weed killers, sheep dip, alloys, and pharmaceuticals.

Production of arsenical insecticides and consumption of arsenical wood preservatives, in the United States, 1941–44 (average), and 1945–49

Year	Production of insecticides (short tons) [1]		Consumption of wood preservatives (pounds) [2]
	Lead arsenate (acid and basic)	Calcium arsenate (100 percent $Ca_3(AsO_4)_2$)	Wolman salts (25 percent sodium arsenate)
1941–44 (average)	37,694	32,046	1,128,854
1945	35,261	[3] 12,822	732,154
1946	28,334	17,696	1,669,889
1947	15,094	23,594	1,156,847
1948	[3] 12,316	[3] 13,618	1,286,302
1949	8,434	8,003	[4] 1,003,992

[1] Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce.
[2] Forest Service, U. S. Department of Agriculture.
[3] Revised figure.
[4] Preliminary figure.

STOCKS

Year-end producers' stocks of white arsenic for 1949 rose sharply for the third consecutive 12-month period, reaching 7,326 short tons, and were the highest since 1939, the first year for which the Bureau of Mines compiled such data.

PRICES

The carlot quotation for refined white arsenic held at 6 cents per pound for the first 9 months of 1949, dropping to 5¾ cents in the last quarter.

FOREIGN TRADE [1]

Imports.—Domestic receipts of white arsenic in 1949 plummeted for the second successive year and reached the lowest level recorded since 1922. Mexico accounted for 96 percent of the total in 1949.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

All 1949 imports of arsenic sulfide (value $5,594) originated in Belgium-Luxembourg; arsenical sheep dips ($9,809) came exclusively from the United Kingdom. Arsenic metal (total value $18,832) was received from Poland-Danzig (21,164 pounds), United Kingdom (13,405), and Sweden (10,800).

Arsenicals imported into and exported from the United States by classes, 1940–44 (average), and 1945–49, in pounds

[U. S. Department of Commerce]

Class	1940–44 (average)	1945	1946	1947	1948	1949
Imports for consumption:						
White arsenic (As_2O_3 content)	[1] 25,059,060	26,297,962	27,641,765	27,879,965	18,671,621	9,392,699
Metallic arsenic	10,111	51,501	92,064	18,928	36,587	45,369
Sulfide	46,294	2,226,560	88,184	44,092	88,608	44,092
Sheep dip	207,772	197,000	1,460	83,654	38,275	55,830
Lead arsenate			552	120,000		
Exports:						
White arsenic	[2] 3,174,778	1,715,855	[1] 2,000,000	[1] 2,000,000	(3)	(3)
Calcium arsenate	4,702,873	3,499,625	6,877,347	4,967,249	4,569,346	4,047,406
Lead arsenate	4,081,320	6,339,103	2,795,205	3,103,863	2,037,645	860,530

[1] Approximate figure.
[2] 1940–42: As reported to Bureau of Mines by producers; 1943–44: As reported by U. S. Department of Commerce. An additional 1,077,244 pounds was exported by dealers in 1941.
[3] Beginning Jan. 1, 1946, not separately classified. Figures for 1946–47 are conjectural; none believed exported in 1948–49

White arsenic (As_2O_3 content) imported for consumption in the United States, by countries, 1945–49

[U. S. Department of Commerce]

Country	1945		1946		1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Belgium-Luxembourg							5	$961	30	$1,997
Bolivia					11	$1,040				
Canada	1	$73	275	$24,074	109	10,414	83	6,278	96	11,816
France					55	6,230				
Italy							337	57,479		
Mexico	9,665	533,305	10,309	571,483	10,710	773,133	7,132	598,989	4,511	544,895
Peru	3,483	154,595	[1] 2,344	100,693	150	16,394	98	8,860		
Poland-Danzig					177	24,922			48	4,866
Portugal					55	8,207	28	4,409		
Sweden			642	57,942	1,228	148,669	1,204	157,233	11	1,261
U. S. S. R.			251	18,833	1,445	156,459	449	49,320		
Total	13,149	687,973	[1] 13,821	773,025	13,940	1,145,468	9,336	883,529	4,696	564,835

[1] Corrected figure.

Exports.—Producers of white arsenic reported no foreign sales in 1949. Shipments of calcium arsenate to European countries eligible for aid from the Economic Cooperation Administration dropped noticeably below 1948 but were still significant; increased demand from the important Latin American market was a compensating factor, accounting for 68 percent of total exports. Colombia was the principal recipient. The lead arsenate export pattern, which had been distorted in 1948 by large ECA-financed shipments to the Orient, reverted to normal in 1949, almost 97 percent of all material exported being destined for Latin America, notably Brazil and Cuba.

TECHNOLOGY

A method was described for plant-scale production of crystalline and amorphous arsenic metal by thermal dissociation of arsenopyrite,[2] and commercial processes were reviewed for separating arsenic from antimony [3] by flotation, caustic soda interaction, and roasting. The problems involved in the treatment of arsenical gold ores continued to receive attention.[4]

WORLD REVIEW

Australia.—About 61,000 tons of white arsenic were produced in Australia to the end of 1948; of this total the Wiluna gold mine in Western Australia accounted for 39,000 tons in the period 1931–47. As of September 1, 1948, Victor Leggo Mining Co. Pty., Ltd., Bendigo, Victoria, set the purchase price of arsenic contained in gold ores at 4s. 5d. per unit.[5]

Belgium.—Various arsenic products are made by Société Générale Métallurgique de Hoboken at plants near Antwerp, Herenthals, and at Reppel, near Bree (white arsenic, yellow and red sulfides, insecticides and other compounds); by Société des Mines et Fonderies de Zinc de la Vieille-Montagne, Liège (arsenicals); and by Belgochimie S. A., Ghent (arsenical copper and lead and calcium arsenate).

France.—Société Minère et Métallurgique de Penarroya produces arsenic compounds as byproducts of smelting lead, zinc, and silver ores at plants located at Noyelles-Godault and Estaque.

Greece.—White arsenic is recovered at the lead-silver smelter of Compagnie Française des Mines du Laurium, Ergosteria.

Hungary.—Sizable bodies of enargite ore have been reported discovered at the Recsk gold-copper mine.[6] It is stated that the property which shut down in 1948 will reopen and that arsenic will be produced in quantity.

Mexico.—Byproduct white arsenic is recovered by Compañia Metalurgica Peñoles, S. A. (subsidiary of American Metal Co.), at its Torreon, Coahuila, lead smelter. During the year additional baghouse facilities were placed in operation. The copper smelter of American Smelting & Refining Co., San Luis Potosi, S. L. P., also produced white arsenic.

Tunisia.—Arsenical lead and white arsenic are byproducts of lead smelting at the Djebel-Hallouf plant of Société Anonyme Française du Djebel-Hallouf. Ore is obtained from the mine at Souk-El-Khemis.

United Kingdom.—Arsenic metal is produced by Metallo Chemical Refining Co., Ltd., and Imperial Smelting Corp., Ltd., London. The latter company also produces arsenic alloys. Arsenical copper is made by British Copper Refiners, Ltd., Prescot, Lancashire.

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[2] Echo des mines et de la metallurgie, La Fabrication electrothermique de l'arsenic: Vol. 77, No. 3414, November 1949, p. 142.

[3] Wendt, Walter, Separation of Arsenic and Antimony: Chemical Age, vol. 6, No. 1577, Oct. 1, 1949, pp. 459–462.

[4] Archibald, F. R., Roasting Arsenical Gold Ores and Concentrates: Canadian Min. and Met. Bull., vol. 42, No. 443, March 1949, pp. 129–139.

Norwood, A. F. B., Contributed Discussion on "Roasting Arsenical Gold Ores and Concentrates": Canadian Min. and Met. Bull., vol. 42, No. 449, September 1949, pp. 460–462.

Thompson, James V. (to The Dorr Co.), Arsenical Gold Ore Treatment: U. S. Patent 2,477,469, July 26, 1949.

Matthews, Owen, "Fluosolids" Roasting of Arsenopyrite Concentrates at Cochenour Willians: Canadian Min. and Met. Bull., vol. 42, No. 444, April 1949, pp. 178–187.

[5] Queensland Government Mining Journal, vol. 50, No. 577, November 1949, p. 649.

[6] Mining World, vol. 11, No. 8, August 1949. p. 47.

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World production of white arsenic, by countries, in metric tons, 1944–49 [1]

[Compiled by Berenice B. Mitchell]

Country [1]	1944	1945	1946	1947	1948	1949
Argentina [2]	432	42	(3)	(3)	(3)	(3)
Australia	2,341	2,021	1,651	1,210	520	[4] 69
Austria [2]	(3)	(3)	(3)	(3)	(3)	(3)
Belgium-Luxembourg (exports)	------	------	(3)	(3)	151	527
Brazil	840	962	829	1,001	984	(3)
Canada	1,192	928	338	357	527	272
France	1,704	1,530	3,140	2,510	3,000	(3)
Germany	[5] [6] 579	(3)	(3)	(3)	(3)	(3)
Greece	------	------	8	14	18	13
Italy	266	100	1,420	1,620	1,730	[7] 1,050
Japan	[8] 1,415	(3)	1,092	1,407	1,765	(3)
Mexico	15,306	15,013	9,648	9,685	7,571	3,576
New Zealand	16	17	18	8	8	(3)
Peru	6,900	3,200	753	608	1,011	500
Portugal	347	243	508	1,005	(3)	[4] 228
Southern Rhodesia	857	624	216	416	283	148
Spain	337	393	440	484	573	(3)
Sweden	3,044	6,119	10,109	16,088	[9] 19,100	(3)
Union of South Africa	------	100	12	3	13	(3)
United Kingdom [10]	141	117	147	91	(3)	(3)
United States	32,744	22,089	9,263	17,014	16,909	11,607
Total [11]	68,000	55,600	41,000	56,000	57,000	36,000

[1] Arsenic is also believed to be produced in China, Czechoslovakia, Hungary, Iran, Korea, Turkey, and U. S. S. R., but data are not available.
[2] Arsenic content of ore mined.
[3] Data not available; estimate by author of chapter included in total.
[4] January to June, inclusive.
[5] Exports.
[6] January to July, inclusive.
[7] January to September, inclusive.
[8] Incomplete.
[9] Includes 7,900 metric tons crude (92.99% As_2O_3).
[10] White arsenic, including arsenic soot.
[11] Estimated by author of chapter; excludes countries listed in footnote 1.

Asbestos

By G. W. Josephson and F. M. Barsigian

GENERAL SUMMARY

EARLY in 1949 there were some indications that supply and demand for asbestos were coming into balance. This situation, however, was changed by a long strike in the Canadian asbestos field. During the strike stocks in consumers' hands approached exhaustion, and after the settlement asbestos was generally in short supply as consumers attempted to catch up on backlog and accumulate working stocks.

In the United States a new asbestos production record was established, but only a small part (8 percent) of our total requirements were supplied from domestic mines.

Our domestic production comes principally from a single chrysotile mine in Vermont; relatively small quantities (including some chrysotile of spinning grade) were mined in Arizona. There was also a small output of amphibole asbestos in a number of other States.

Although demand in the United States was at a high level, imports from foreign sources were lower than in the record year 1948 because of the strike in Canada. Small quantities of chrysotile were imported from Southern Rhodesia and Russia. South Africa supplied all of the amosite and nearly all of the crocidolite consumed in the United States. Interest is developing in Bolivian crocidolite, which has been found to be a good raw material for filtering uses.

Industrial demand for asbestos absorbed most of the available supply, and consequently stockpiling was difficult, but some progress was made in substitution programs. After a price increase at the first of the year, prices of raw asbestos remained comparatively stable during 1949.

Salient statistics of the asbestos industry in the United States, 1948–49

	1948		1949	
	Short tons	Value	Short tons	Value
Domestic asbestos—				
Produced	37,237	(1)	42,918	(1)
Sold or used by producers	37,092	$1,806,261	43,387	$2,614,416
Imports (unmanufactured)	647,881	37,974,092	515,303	33,939,582
Exports (unmanufactured)	6,530	1,173,259	17,621	3,618,703
Apparent consumption [2]	678,443	38,607,094	541,069	32,935,295
Exports of asbestos products	(1)	10,471,059	(1)	10,898,047

[1] Figure not available.
[2] Quantity sold or used by producers, plus imports, minus exports.

PRODUCTION

Production of asbestos in the United States reached a record of 42,918 short tons in 1949, 15 percent more than in 1948. Chrysotile was produced in Vermont and Arizona, and some development work was reported in California. Amphibole output was reported from California, Georgia, and Oregon.

Asbestos sold or used by producers in the United States, 1945–49, by varieties

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	11,986	$442,056	240	$3,989	12,226	$446,045
1946	13,645	499,260	430	5,504	14,075	504,764
1947	23,586	912,340	449	6,218	24,035	918,558
1948	(1)	(1)	(1)	(1)	37,092	1,806,261
1949	(1)	(1)	(1)	(1)	43,387	2,614,416

[1] Bureau of Mines not at liberty to publish figure separately.

Alaska.—There was no production of asbestos in 1949 from the Alaskan deposits in the Kobuk River district. A comprehensive report on these deposits was issued by the Bureau of Mines.[1]

Arizona.—In 1949 chrysotile production in Arizona was somewhat lower than in the previous year, but some high-quality material suitable for the National Stock Pile was recovered. The following firms and individuals were active: Apache Asbestos Mines, Inc., 3402 North Central Ave., Phoenix; Arthur Enders, P. O. Box 362, Globe; Charles Ireland, P. O. Box 374, Globe; Kyle Asbestos Mines of Arizona, P. O. Box 302, Globe; Phillips Asbestos Mines, P. O. Box 71, Globe; and R. G. Robertson (Bear Canyon mine).

California.—In Shasta County production of tremolite in the Sylvester mine was reported by the Powhatan Mining Co., Woodlawn, Baltimore, Md. Homer E. Fenn and associates did some development work at the Stock Asbestos mine. Huntley Industrial Minerals, Inc., P. O. Box 305, Bishop, Calif., has reported that it expects to start production of asbestos in Inyo County about May 1, 1950. The Blas Asbestos Corp., La Moine, Calif., continued development of its chrysotile asbestos deposit and mill in Shasta County but was not in commercial production.

Georgia.—Powhatan Mining Co. produced anthophyllite in Rabun County, Ga., near Dillard. Industrial Minerals Corp. reported development work on tremolite in Rabun County.

Montana.—Considerable development work was done by Interstate Products Co., Inc. (126 Ave. C, Billings, Mont.), in Gallatin County. Several deposits of amphibole asbestos have been opened.

North Carolina.—There was no commercial production reported in North Carolina in 1949, but Industrial Minerals Corp., Asheville, continued development work on amphibole deposits in Macon and Yancey Counties.

Oregon.—Philip S. Hoyt, P. O. Box 83, Aguila, Ariz., reported some production in Oregon of asbestos suitable for use as filter fiber.

[1] Heide, H. E., Wright, W. S., and Rutledge, F. A., Investigations of the Kobuk River Asbestos Deposits, Kobuk District, Northwestern Alaska: Bureau of Mines Rept. of Investigations 4414, 1949, 25 pp.

Vermont.—The Vermont Asbestos Mines Division of the Ruberoid Co., 500 Fifth Ave., New York 18, N. Y., the largest producer of asbestos in the United States, increased the output of its mine and placed a new fiber-processing mill in operation at Lowell, Vt., in 1949. The company consumes this chrysotile asbestos in the manufacture of asbestos products.

CONSUMPTION AND USES

As shown in the accompanying table, the apparent consumption of raw asbestos in the United States was substantially lower in 1949 than it was in 1948. There were industry reports that demands for various asbestos products were declining, particularly in the early part of the year, but a substantial part of the drop in total consumption can be attributed to the shortage of asbestos caused by the Canadian strike. Whereas there were declines in demand for textiles and some additional asbestos products, sales of others, such as asbestos-cement products, were sustained by the high level of activity maintained by the building industry. The relationships between the consumption of asbestos and activity in its major markets—construction and industry in general—during the past 30 years, are shown graphically in figure 1.

A table showing output of asbestos products in the United States in 1939 and 1947, compiled from the Census of Manufacturers, was published in Minerals Yearbook, 1948, page 146.

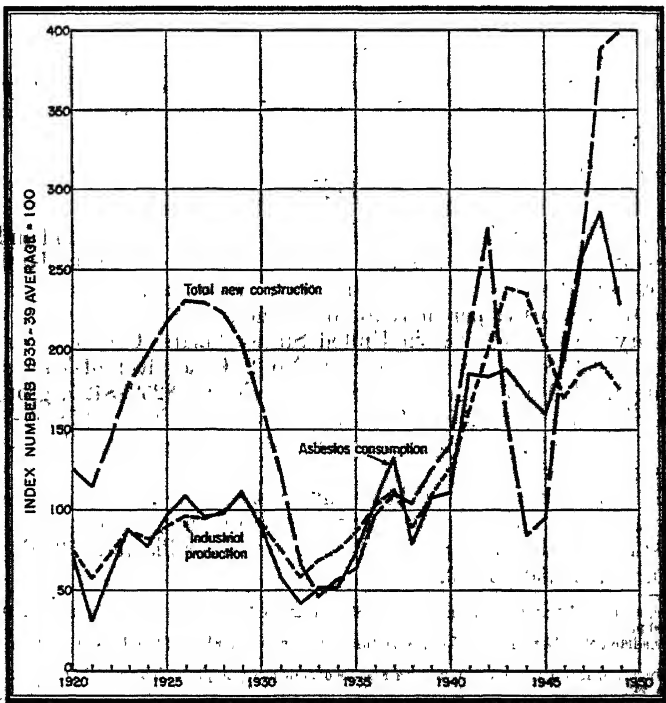

FIGURE 1.—Consumption of asbestos compared with total new construction and industrial production, 1920–49. Statistics on value of construction from Bureau of Foreign and Domestic Commerce and on industrial production from Federal Reserve Board.

Apparent consumption of raw asbestos in the United States, 1945–49

Year	Short tons	Value	Year	Short tons	Value
1945	378,030	$15,926,622	1948	678,443	$38,607,094
1946	459,752	17,840,775	1949	541,069	32,935,295
1947	616,787	30,423,663			

In general, the demand for raw asbestos was very active during 1949, both in the United States and elsewhere. New uses continued to appear, and a number of consumers continued their expansion programs, although probably not at the rate that would have been attained if an ample supply of asbestos had been available. The need for asbestos has become well known throughout the world, and consequently exploration projects have been very active in many areas. New mines have not yet made very large contributions to current supply, but several show promise.

The shortages of the higher grades of asbestos obtained from Africa continued throughout 1949, and consequently greater emphasis was put on beneficiation and substitution programs.

Several revealing publications on asbestos uses were issued in 1949. These included a manual on 85-percent-magnesia insulation [2] and a pamphlet on the properties and uses of shorts and floats.[3] A new type of high-quality asphalt roofing having a surface coating of asbestos fibers was introduced. This shingle is said to have exceptionally high fire resistance.[4]

A description of the use of asbestos in brake linings was published.[5] Asbestos is a principal constituent of a new type of high-efficiency air filter. It is reported that Bolivian crocidolite, which has had comparatively little market in the past, is particularly suited to that application.

PRICES

Trade-journal price quotations for all grades of crude and milled asbestos from both Canada and Vermont were increased in January and remained constant for the entire year. As quoted in the magazine, Asbestos, the prices per short ton of Canadian fiber, f. o. b. mines, in January were as follows, in United States dollars: Group 1 (Crude No. 1), $960–$1,050; group 2 (Crude No. 2, Crude Run-of-Mine, and Sundry), $400–$550; group 3 (Spinning Fiber), $232–$425; group 4 (Shingle Fiber), $95.50–$141; group 5 (Paper Fiber), $78.50–$88; group 6 (Waste, Stucco, or Plaster), $58; and group 7 (Refuse or Shorts), $28–$52.

The prices of Vermont asbestos in short tons f. o. b. Hyde Park or Morrisville, Vt., quoted in January 1949, were: Shingle Fiber, $111.50–$124; Paper Fiber, $79–$96.50; Waste, Stucco, or Plaster, $59; Refuse or Shorts, $28.50–$52.50.

[2] Magnesia Insulation Manufacturers Assoc., 85% Magnesia Insulation Manual: Washington, D. C., 1949, 90 pp.

[3] Ca[illegible] Co., Ltd., Asbestos Fibre Shorts and Floats Their Uses in Industry: 1949, 11 pp.

[4] Asbestos (magazine), Asbestos Coating a Feature of New Carey Asphalt Shingle: Vol. 30, No. 12, June 1949, p. 24.

[5] Halstead, R. T., Brake Linings of Various Types and Their Manufacture: Asbestos, vol. 31, No. 2, August 1949, pp. 6–12; vol. 31, No. 3, September 1949, pp. 8–13.

FOREIGN TRADE [6]

As the United States is the principal consumer of asbestos and produces only a small percentage (8 percent in 1949) of its requirements, large tonnages are imported. In 1949 imports of unmanufactured asbestos were 20 percent lower than in 1948. Of the total, 91 percent came from Canada, 4 from Southern Rhodesia, and 4 from the Union of South Africa. Smaller quantities were received from Russia and other countries.

Asbestos imported for consumption in the United States, and asbestos and asbestos products exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Asbestos (unmanufactured)				Manufactured asbestos products-exports (value)
	Imports		Exports		
	Short tons	Value	Short tons	Value	
1945	374,354	$16,317,752	8,550	$837,175	$7,264,288
1946	456,688	18,731,378	11,011	1,395,367	9,263,092
1947	594,839	29,821,519	2,087	316,414	12,823,480
1948	647,881	37,974,092	6,530	1,173,259	10,471,059
1949	515,303	33,939,582	17,621	3,618,703	10,898,017

Asbestos (unmanufactured) imported for consumption in the United States, by countries and classes, 1948–49

[U. S. Department of Commerce]

Country	Crude (including blue fiber)		Mill fibers		Short fibers		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1948								
Australia	3	$1,550					3	$1,550
Bolivia	68	11,445					68	11,445
Canada	676	361,316	168,690	$16,884,386	432,850	$14,512,547	602,216	31,758,249
China			2	238			2	238
India	(1)	68					(1)	68
Italy			[2] 9	[2] 7,284	[2] 1	[2] 3,838	10	11,122
Southern British Africa	692	87,741					692	87,741
Southern Rhodesia [3]	10,463	2,033,398	20	6,873	30	8,546	10,513	2,048,817
Turkey					4	400	4	400
Union of South Africa	18,859	2,073,371					18,859	2,073,371
U. S. S. R.	7,327	851,656	8,187	1,129,380			15,514	1,981,036
United Kingdom	(1)	55					(1)	55
Total	38,088	5,420,600	[2]176,908	[2]18,028,161	[2]432,885	[2]14,525,331	647,881	37,974,092
1949								
Australia	249	58,965					249	58,965
Bolivia	69	9,927					69	9,927
Canada	1,595	401,678	126,596	14,348,702	342,590	12,721,533	470,781	27,471,913
Italy	23	1,211	76	8,786			99	9,997
Portugal	(1)	65					(1)	65
Southern British Africa	647	97,580					647	97,580
Southern Rhodesia [3]	22,415	3,130,024	81	30,395			22,496	3,160,419
Spain	(1)	27					(1)	27
Union of South Africa	19,735	2,973,534					19,735	2,973,534
U. S. S. R.	1,221	156,850					1,221	156,850
United Kingdom	6	278					6	278
Venezuela			(1)	27			(1)	27
Total	45,960	6,830,129	126,753	14,387,910	342,590	12,721,533	515,303	33,939,582

[1] Less than 1 ton.
[2] Revised figure.
[3] Includes the following crude credited to Mozambique by the U. S. Department of Commerce: 1948—1,055 tons, $106,431; 1949—3,848 tons, $269,941.

[6] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

As compared with imports, United States exports of unmanufactured asbestos are comparatively small. However, in 1949 exports were almost three times as great as in 1948. The value of manufactured asbestos products shipped out of the country is substantial.

Manufactured asbestos products exported from the United States, 1948–49, by kinds

[U. S. Department of Commerce]

Products	1948		1949	
	Quantity	Value	Quantity	Value
Brake blocks short tons	132	$219,670	142	$275,293
Brake lining:				
Molded and semimolded do	1,301	2,238,135	1,543	2,641,045
Not molded linear feet	681,364	404,085	763,961	479,645
Clutch facing number	1,134,146	550,937	934,820	523,756
Pipe covering and cement short tons	1,599	298,781	4,336	963,599
Textiles, yarn, packing and sheets do	5,293	2,758,200	1,209	1,891,831
Asbestos construction materials, and other manufactures, n. e. s., including roofing	(1)	[1] 2,851,543	(1)	[1] 2,891,391
Magnesia and manufactures	(2)	1,149,708	(2)	1,231,457
Total		10,471,059		10,898,017

[1] Classified by the U. S. Department of Commerce: 1948—Paper, millboard, and rollboard, 1,639 tons, $308,384; asbestos roofing, 210,238 squares, $1,392,071; other asbestos manufactures, except roofing, $1,151,088; 1949—Asbestos construction materials, 21,362 tons, $2,418,172; other asbestos manufactures, except roofing, $473,219.
[2] Quantity not recorded.

New classifications available on exports of unmanufactured asbestos in 1949 provided the following additional data: Crude and Spinning Fibers, 5,885 long tons (6,591 short tons) valued at $1,741,984; nonspinning, 4,947 long tons (5,541 short tons) valued at $1,327,876; Waste and Refuse, 4,901 long tons (5,489 short tons) valued at $548,843.

TECHNOLOGY

The industry is making real progress in the search for methods of removing magnetite from Canadian chrysotile to make it acceptable for the highest specification cable wrapping applications. The Johns-Manville Co. is producing Quinterra paper for this purpose, and the Raybestos Manhattan Co. has another wet-process beneficiation pilot plant in operation.

Much work has been done in recent years on crystal-growth problems, and the body of information is reaching a point where technologists feel that there is prospect of discovering methods of synthesizing asbestos in quantity. It is anticipated that these products may not have exactly the same chemical compositions as the natural forms of asbestos but will have similar physical properties. Such investigations are being continued both in the laboratories of private firms and the Government. A project on asbestos synthesis was established at the Norris, Tenn., station of the Bureau of Mines in 1949.

A paper on filterability of asbestos fibers used in wet process [7] and a review of current methods of mining and milling asbestos [8] were published.

WORLD REVIEW

Although official statistics are too incomplete to make a highly accurate estimate possible at this time, it is believed that world output of asbestos in 1949 was of the order of 100,000 tons lower than in 1948, owing to interruption of production in Canada, which was only partly compensated by moderate increases in other countries.

World production of asbestos by countries, 1944–49, in metric tons [1]

[Compiled by Helen L. Hunt]

Country [1]	1944	1945	1946	1947	1948	1949
Argentina	292	153	(2)	(2)	(2)	(2)
Australia:						
New South Wales	2,598	2,674	241	290	330	(2)
South Australia	6	7	8	40	41	[3] 13
Tasmania	105	281				(2)
Western Australia	313	1,109	380	1,069	977	[4] 433
Bolivia (exports)	13	61		141	147	(2)
Brazil	(2)	(2)	(2)	3,471	(2)	(2)
Canada (sales) [5]	380,349	423,559	506,371	600,391	650,239	521,543
Chile	(2)	313	280	(2)	150	(2)
Cyprus	2,568	3,182	4,142	6,795	8,106	[6] 11,276
Egypt	240	85	65	1,015	1,625	120
Finland [7]	7,733	4,197	5,781	6,351	10,818	(2)
France	31	400	575	934	(2)	(2)
French Indochina	242					(2)
French Morocco	506	480	446	825	399	402
India	592	833	312	123	28	(2)
Italy	7,238	5,222	8,814	10,719	13,644	[8] 15,000
Japan	12,900	8,044	3,997	4,249	4,809	5,456
Kenya	341	389	165	582	510	716
Korea:						
Northern	415	1,303	(2)	(2)	(2)	(2)
Southern	4,117					
Madagascar	3	1	1	(9)	(9)	(2)
New Zealand	17	2				(2)
Portugal	33	20	12	91	(9)	(2)
Southern Rhodesia	52,882	51,068	50,686	49,073	62,507	72,246
Spain					35	(2)
Swaziland	29,628	21,243	29,155	25,360	29,421	30,814
Switzerland	7	35	40			(2)
Turkey	234	138	55	36	203	170
Union of South Africa	31,372	25,597	18,348	27,344	41,490	[4] 46,028
United States (sold or used by producers)	6,048	11,091	12,769	21,804	33,649	39,360
Venezuela	(2)	(2)	65	293	192	[8] 200
Total (estimate)	602,000	632,000	724,000	872,000	995,000	895,000

[1] In addition to countries listed asbestos is produced in Algeria, Bulgaria, China, Czechoslovakia, Uganda, and U. S. S. R. Estimates by authors of the chapter are included in total.
[2] Data not available; estimate by authors of the chapter included in total.
[3] January to June, inclusive.
[4] January to September, inclusive.
[5] Exclusive of sand, gravel, and stone (waste rock only), production of which is reported as follows: 1944, 4.101 tons; 1945, 4,635 tons; 1946, 5,749 tons; 1947–49 data not available.
[6] Exports.
[7] Includes asbestos flour.
[8] Estimate.
[9] Less than 1 ton.

CANADA

In 1949 asbestos production in Canada dropped to 574,906 short tons valued at $39,746,072. This 20-percent decrease in tonnage from the output record established in 1948 was due to the strike in the Thetford mines district that lasted from February 13 to July 5.[9]

[7] Badollet, M. S., Filterability of Asbestos Fibers Used in Wet Processes: Canadian Min. and Met. Bull., vol. 42, No. 451, November 1949, pp. 594–598.
[8] Messel, M. J., Recent Trends in Asbestos Mining and Milling Practice: Min. Eng., vol. 1, No. 2, February 1949, pp. 52–55.
[9] Engineering and Mining Journal, Quebec: Vol. 150, No. 8, August 1949, p. 122.

Partly as a result of the strike and partly because of the high world-wide demand for asbestos, exploration and development activities were at a high level in Canada during 1949. Outstanding was the announcement by the Johns-Manville Co. of the discovery and projected development of a rich asbestos deposit 9 miles east of Matheson, Ontario, in the Larder Lake district, Munro Township. A new mill having an hourly capacity of 50 tons of mill rock is to be built, and mine production was expected in mid-1950.[10]

Sales of asbestos in Canada, 1948–49, by grades

[Quebec Department of Mines]

	1948			1949		
		Value			Value	
	Short tons	Total	Average per ton	Short tons	Total	Average per ton
Grade:						
Crudes	977	$594, 594	$608. 59	652	$420, 188	$644. 46
Fibers	241, 953	25, 943, 710	107. 23	194, 583	24, 463, 703	125. 72
Shorts	473, 839	15, 693, 171	33. 12	379, 671	14, 862, 181	39. 14
Total	716, 769	42, 231, 475	58. 92	574, 906	39, 746, 072	69. 13
Rock mined	10, 759, 016			(1)		
Rock milled	7, 894, 461			(1)		

1 Data not available.

Prospecting and development work on many other properties were also reported. It was said that a claim in Deloro Township, Porcupine area, northern Ontario, which had been idle since World War I, is to be opened by the Teegana Mines, Ltd.[11] Calabogie Asbestos Mining Co., Ltd., planned development of a 200-acre property in Blythfield Township, Renfrew County, Ontario.[12] Three groups of claims in Joannes, Dasserat, and Rigaud-Vadreuil Townships, Quebec, were to be extensively explored by Arnora Gold Mines, Ltd.[13] The United Asbestos Corp. announced that it had obtained surface rights on the shores of Black Lake, under which its deposit lies, suitable for a mill site.[14] The Acme Asbestos Co., Ltd., Vancouver, B. C., optioned a group of chrysotile asbestos claims on Sproat Mountain, 4 miles north of Arrowhead, B. C. The asbestos is said to be of good quality, but the extent of the deposit is not known.[15] Bar-Lan Gold Mines has commenced surface work on its newly acquired asbestos property in Coleraine Township, Quebec.[16]

AFRICA

Southern Rhodesia.—As shown in the accompanying table, chrysotile asbestos production in Southern Rhodesia increased considerably in 1949. The bulk of this output comes from mines operated by Rhodesian & General Asbestos Corp., a subsidiary of Turner & Newall,

10 Johns-Manville Stockholders' News, J-M Discovers New Asbestos Deposits: July 1949.
11 Northern Miner, Teegana Seeks Asbestos on Deloro Property: Vol. 35, No. 33, Nov. 10, 1949, p. 7.
12 Northern Miner, Calabogie Asbestos Plans Development Program: Vol. 35, No. 18, July 28, 1949, p. 7.
13 Northern Miner, Arnora Looks for Asbestos: Vol. 35, No. 11, June 9, 1949, p. 9.
14 Northern Miner, United Asbestos Plans Shaft Sinking: Vol. 35, No. 34, Nov. 17, 1949, p. 3.
15 Northern Miner, Asbestos Properties in B. C. Optioned: Vol. 35, No. 17, July 21, 1949, p. 11.
16 Northern Miner, Bar-Lan Starts Work on Asbestos Group: Vol. 34, No. 48, Feb. 17, 1949, p. 23.

Ltd. They include the Nil Desperandum, Sphinx, Birthday, 170, and 177 lodes in the Shabani district; the King and Gath mines in the Mashaba district; and the Croft mine in the Filabusi district. In the past few years many asbestos properties in Southern Rhodesia have been opened, but they are contributing a relatively small tonnage to the total. Shipments were started from the new Vanguard Asbestos Mines operation at Belingwe.[17]

Asbestos produced in Southern Rhodesia, 1944–49

Year	Short tons	Value	Year	Short tons	Value
1944	58,293	£1,674,467	1947	54,094	£1,738,484
1945	[1] 56,293	1,788,386	1948	68,897	2,604,623
1946	55,872	1,676,503	1949	79,638	3,986,703

[1] Revised figure.

Swaziland.—The increase in chrysotile production at the Havelock mine in Swaziland was not very great tonnagewise, but it was enough to raise the total to a new record of 30,814 metric tons in 1949.

Union of South Africa.—Results of the amosite expansion program are beginning to show in the production figures, which reached a record total of 31,392 short tons in 1949. As shown in the accompanying table, there was also an increase in output of Transvaal Blue. A trade-journal report in October indicated that the number of asbestos mills in the Transvaal had increased since July 1948 from 6 to 27, with several more in construction.[18]

Expansion of the Benoni asbestos products factory operated by Cape Asbestos Insulation (Pty.) is expected to double its current rate of asbestos consumption, 300 tons per month.[19]

Asbestos produced in and exported from the Union of South Africa, 1945–49[1]

Year	Production (short tons)			Exports	
	Transvaal	Cape Province	Total	Short tons	Value
1945	20,016	8,200	28,216	22,005	£591,124
1946	12,636	7,589	20,225	21,481	557,008
1947	21,959	8,183	30,142	33,237	927,371
1948	37,434	8,301	45,735	38,559	1,138,792
1949 [2]	42,326	8,412	50,738	42,800	1,632,515

[1] Data from Union of South Africa, Department of Mines, Quarterly Report.
[2] January to September, inclusive.

[17] South African Mining and Engineering Journal, New Rhodesian Asbestos Mine: Vol. 60, No. 2940, June 18, 1949, p. 527.
[18] South African Mining and Engineering Journal, Mining in N. Transvaal: Vol. 60, No. 2956, Oct. 8, 1949, p. 153.
[19] South African Mining and Engineering Journal, Asbestos Plant to Double Output: Vol. 60, No. 2936, May 21, 1949, p. 387.

Asbestos produced in the Union of South Africa, 1944–49, by varieties and sources, in short tons [1]

Variety and source	1944	1945	1946	1947	1948	1949 [2]
Amosite (Transvaal)	22,848	16,737	9,838	18,780	30,372	31,392
Chrysotile (Transvaal)	2,014	1,765	1,666	2,253	4,441	5,224
Blue (Transvaal)	1,831	1,471	1,102	896	2,608	5,710
Blue (Cape)	7,835	8,200	7,589	8,183	8,301	8,412
Anthophyllite (Transvaal)	54	43	30	30	13	----------
Total	34,582	28,216	20,225	30,142	45,735	50,738

[1] Data from Union of South Africa, Department of Mines, Quarterly Report.
[2] January to September, inclusive.

OTHER COUNTRIES

Inasmuch as such information is scattered and difficult to obtain, a series of short articles published in the magazine Asbestos, outlining asbestos production and occurrences in a number of countries, is of interest. In 1949 information was published on Albania, Australia, Bulgaria, China, Cyprus, Czechoslovakia, Egypt, Eritrea, Finland, France, French Morocco, Germany, Greece, India, Indochina, Italy, Japan, and South America.

Australia.—A small tonnage of asbestos was produced in Australia in 1949. The bulk was blue asbestos produced in Western Australia. It was reported that surveys made by the State Mines Department were expected to lead to the opening of new white asbestos deposits in Tasmania.[20]

Austria.—A discovery of a deposit of asbestos was reported from Rottenmann, Styria.[21]

Bolivia.—Output of Bolivian crocidolite was small in 1949, but it may increase in future if the use of dry filters, for which it appears to be particularly suitable, reaches a substantial magnitude.

Colombia.—Exploration of two deposits, near the towns of Yarumal and Antioquia, in Antioquia, was reported.[22]

India.—Deposits of good asbestos are reported to be mined by primitive methods and shipped in raw form from Brahmanapalli, Cuddapah, and Lopatantulu districts.[23]

Italy.—Italian asbestos production is small but a record rate was attained.[24]

Venezuela.—Asbestos production in Venezuela continued at a low rate. The only producer, C. A. Minas de Amianto de Tinaquillo, which operates the El Tigre mine near Tinaquillo, is attempting to expand.

[20] Mining World, vol. 11, No. 2, February 1949, p. 61.
[21] Mining World, vol. 11, No. 8, July 1949, p. 52.
[22] Engineering and Mining Journal, vol. 150, No.

131.
1949, p. 541.

Asphalt and Related Bitumens

By A. H. Redfield and Sarah J. Spencer

GENERAL SUMMARY

DOMESTIC demand[1] for petroleum asphalt was nearly 1 percent lower in 1949 than in 1948, but export demand was 13 percent lower. As export demand was only 2½ percent of the total demand, the total demand decreased a little more than 1 percent from 1948 to 1949. In numerical terms, a decrease of 87,400 tons in domestic demand, coupled with a decrease of 35,500 tons in export demand, was met by a decrease of 529,500 tons in refinery production and a decrease of 70,700 tons in imports of petroleum and lake asphalt. As a result, stocks held at the refineries were lowered by 134,400 tons during 1949, compared with additions of 342,900 tons to stocks during 1948.

NATIVE ASPHALT AND BITUMENS

Bituminous Rock.—Sales of bituminous rock by producers in the United States increased from 1,084,004 short tons valued at $3,634,917 in 1948 to 1,150,931 tons valued at $4,264,989 in 1949. Bituminous limestone amounted to 904,183 tons valued at $2,292,873 in 1948 and 920,874 tons valued at $2,536,912 in 1949. Bituminous sandstone totaled 179,821 tons valued at $1,342,044 in 1948 and 230,057 tons valued at $1,728,077 in 1949. One company in Texas, one in Kentucky, one in Oklahoma, and one in Utah were responsible for the general increase. Sales values per ton at the mine were generally higher in 1949 than in 1948.

Gilsonite.—Sales of gilsonite by producers in northeastern Utah decreased from 52,122 short tons valued at $1,390,713 in 1948 to 51,462 tons valued at $1,303,584 in 1949. The average sales value per ton at the mine or railhead decreased from $26.68 in 1948 to $25.33 in 1949.

MANUFACTURED OR PETROLEUM ASPHALT

Production.—Petroleum refineries in the United States produced 8,910,300 short tons of asphalt in 1949, a decrease of 6 percent from the 9,439,800 tons produced in 1948. The decreases were greatest in the East Coast, Indiana-Illinois-Kentucky, etc., and Louisiana Gulf Coast districts. On the other hand, refineries in California and Texas increased their asphalt output from 1948 to 1949.

Stocks.—Stocks of asphalt held at refineries decreased 13 percent from 1,028,600 short tons on December 31, 1948, to 894,200 tons on December 31, 1949. In some of the smaller producing districts, inventories were decreased as much as one-third. In contrast, California refineries increased their stocks 30 percent during the year and refineries of Arkansas and Inland Louisiana 17 percent.

[1] The term "domestic demand" as used in this chapter means apparent consumption, that is, production plus net imports and changes in refiners' stocks.

Production, receipts, stocks, consumption, transfers, losses, exports, and domestic sales of asphalt (exclusive of road oil) at petroleum refineries in the United States in 1949, by districts, in short tons

District	Production	Receipts [1]	Stocks		Consumption by producers, transfers, losses, and exports	Sales to domestic consumers
			Jan. 1	Dec. 31		
East Coast	2, 323, 300	329. 000	140, 500	128, 700	173, 300	2, 490, 800
Appalachian	338, 000	33. 600	61, 400	40, 700	8, 300	384, 000
Indiana, Illinois, Kentucky, etc	1, 636, 500	221, 400	220, 200	186, 600	322, 000	1, 569, 500
Oklahoma, Kansas, and Missouri	896, 500	28, 500	193, 300	127, 000	149, 600	841, 700
Texas:						
Gulf Coast	604, 200	----------	52, 400	45, 300	79, 800	531, 500
Inland	476, 000	1, 300	48, 400	50, 200	88, 900	386, 600
Total Texas	1, 080, 200	1, 300	100, 800	95, 500	168, 700	918, 100
Louisiana-Arkansas:						
Louisiana Gulf Coast	411, 600	----------	71, 300	62, 200	94, 500	326, 200
Arkansas and Inland Louisiana	512, 400	97, 700	68. 000	79, 800	26, 400	571, 900
Total Louisiana-Arkansas	924, 000	97, 700	139, 300	142, 000	120, 900	898, 100
Rocky Mountain	360, 500	80, 900	78, 200	50, 200	104, 500	364, 900
California	1, 351, 300	165, 600	94, 900	123, 500	34, 300	1, 454, 000
Total: 1949	8. 910, 300	958, 000	1, 028, 600	894, 200	1, 081, 600	8, 921, 100
1948	9, 439, 800	1, 401, 300	685, 700	1, 028, 600	1, 320, 100	9, 178, 100

[1] Receipts from interindustry refinery transfers, addition of other petroleum products blended to make cut-back asphalts, imports, and transfers from stocks formerly not classified as asphalt.

Sales.—Sales of petroleum asphalt to domestic consumers decreased 3 percent in quantity for 1948 to 1949 and, because of lower prices, 9 percent in value. The average sales value per short ton decreased from $19.48 in 1948 to $18.21 in 1949. The greatest decreases in tonnage sold were in the East Coast and Louisiana Gulf Coast districts. In contrast to the general trend, Texas Gulf Coast refineries increased their tonnage of sales 48 percent from 1948 to 1949, Appalachian refineries 27 percent, and refineries of Oklahoma-Kansas-Missouri 13 percent. California asphalt sales were slightly larger in 1949 than in 1948.

Of the total sold, 23 percent was manufactured from foreign petroleum (imported chiefly from Venezuela, Colombia, and Mexico) in 1949, compared with 26 percent in 1948. Although runs of foreign crude to stills increased 26 percent from 1948 to 1949, sales of petroleum asphalt from this source decreased 13 percent. Of the foreign crude processed, 10 percent was converted to asphalt in 1948 and 7 percent in 1949. Ninety-nine percent of the asphalt made from foreign crude in 1948 and all of it in 1949 was manufactured in east coast refineries.

Highway and street construction and airport-runway surfacing (in the form of paving asphalt, paving flux, cutback asphalts, and asphalt emulsions) used 67 percent of the total asphalt sold to domestic consumers by petroleum refineries in 1948 and 70 percent in 1949. Sales of all grades of asphalt devoted wholly or principally to street and road construction increased 2 percent in 1949 over 1948.

Sales of asphalt (exclusive of road oil) at petroleum refineries to domestic consumers in the United States, 1948–49, by districts

District	1948		1949	
	Short tons	Value	Short tons	Value
East Coast	2,834,825	$60,541,034	2,490,759	$51,322,977
Appalachian	302,791	5,809,936	383,989	8,199,775
Indiana, Illinois, Kentucky, etc.	1,643,166	31,147,409	1,569,490	27,504,696
Oklahoma, Kansas, and Missouri	745,147	13,483,617	841,653	13,657,223
Texas:				
Gulf Coast	358,945	7,990,127	531,514	9,777,276
Inland	387,232	7,417,835	386,578	7,033,488
Total Texas	746,177	15,407,962	918,092	16,810,764
Louisiana-Arkansas:				
Louisiana Gulf Coast	475,697	9,375,389	326,242	5,487,076
Arkansas and Inland Louisiana	575,183	11,061,445	571,943	9,877,080
Total Louisiana-Arkansas	1,050,880	20,436,834	898,185	15,364,156
Rocky Mountain	409,638	7,458,092	364,929	5,727,228
California	1,445,497	24,503,430	1,453,997	23,850,912
Total United States	9,178,121	178,788,314	8,921,094	162,437,731

Asphalt and asphalt material (exclusive of road oil) sold at petroleum refineries to domestic consumers in the United States in 1949, by form and use

[Value f. o. b. refinery]

Form and use	From domestic petroleum		From foreign petroleum		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration:						
Asphalt for—						
Paving	2,228,274	$38,660,063	774,232	$15,736,325	3,002,506	$54,396,388
Roofing	1,152,939	20,052,342	502,095	9,978,067	1,655,034	30,030,399
Waterproofing	102,814	2,202,002	22,329	483,229	125,143	2,685,231
Blending with rubber	7,386	166,765	10,664	259,525	18,050	426,290
Briquetting	132,810	2,208,996	14,665	300,230	147,475	2,509,226
Mastic and mastic cake	4,750	108,233	37	838	4,787	109,071
Pipe coatings	20,599	525,797	2,776	76,160	23,375	601,957
Molding compounds	49,316	821,572	4,836	115,097	54,152	936,669
Miscellaneous uses	154,628	2,755,495	147,547	2,973,979	302,175	5,729,484
Total	3,853,516	67,501,285	1,479,181	29,923,450	5,332,697	97,424,715
Semisolid and liquid products of more than 200 penetration:						
Flux for—						
Paving	299,998	4,575,440	28,607	580,420	328,605	5,155,860
Roofing	664,328	9,027,298	32,109	600,843	696,437	9,628,141
Waterproofing	24	1,235	1,926	36,497	1,950	37,732
Mastic	6,568	122,329			6,568	122,329
Cut-back asphalts:						
Rapid-curing	914,325	17,896,896	293,990	6,236,743	1,208,315	24,133,639
Medium-curing	982,524	17,883,095	199,749	4,335,396	1,182,273	22,218,491
Emulsified asphalts and fluxes	73,973	1,491,599	178	3,975	74,151	1,495,574
Paints, enamels, japans, and lacquers	39,568	1,277,713	14,254	295,472	53,822	1,573,185
Other liquid products	36,154	645,447	122	2,618	36,276	648,065
Total	3,017,462	52,921,052	575,935	12,091,904	3,588,397	65,013,016
Grand total: 1949	6,870,978	120,422,317	2,050,116	42,015,414	8,921,094	162,437,731
1948	6,821,406	128,414,477	2,356,716	50,373,837	9,178,121	178,788,314

Sales of emulsified asphalts were slightly lower in 1949 than in 1948. Petroleum refineries sold 124,760 short tons (29,395,889 gallons) valued at $2,976,116 in 1948 and 74,151 tons (17,469,975 gallons) valued at $1,495,574 in 1949. In addition, 102,815,746 gallons valued at $11,009,785 in 1948 and 113,199,203 gallons valued at $13,482,130 in 1949 were sold by secondary producers that purchased asphalt from petroleum refineries and manufactured it into emulsions. Accordingly, total known sales of emulsified asphalts and fluxes decreased 1 percent in quantity—from 132,211,635 gallons (561,137 tons) in 1948 to 130,669,178 gallons (554,623 tons) in 1949—but increased 7 percent in value—from $13,985,901 in 1948 to $14,977,704 in 1949.

Roofing manufacture made the second-largest demand for asphalt, absorbing 28 percent of the total sales of asphalt to domestic consumers in 1948 and 26 percent in 1949. Although sales of prepared roofing and asphalt siding reported to the Bureau of the Census declined 13 percent—from 63,219,000 squares in 1948 to 54,856,000 squares in 1949—and of saturated felt 7 percent—from 538,042 short tons in 1948 to 500,688 tons in 1949—domestic sales of roofing asphalt and roofing flux combined decreased 10 percent—from 2,611,092 short tons in 1948 to 2,351,471 tons in 1949. These figures do not include roofing asphalt and flux consumed by the refining companies in factories making prepared roofing and siding and saturated felts, owned by themselves or by affiliated companies.

APPARENT CONSUMPTION

For the first time since 1942, the apparent consumption of asphalt declined. The apparent average monthly domestic consumption of petroleum asphalt (including small quantities of lake asphalt and grahamite) decreased 1 percent—from 795,641 (revised figure) short tons in 1948 to 752,362 tons in 1949. Total apparent consumption was 9,115,697 tons in 1948 and 9,028,348 tons in 1949.

DISTRIBUTION BY RAIL

Although the apparent domestic consumption of petroleum asphalt declined only 1 percent from 1948 to 1949, the tonnage of asphalt terminated by Class I railroads in the United States decreased 17 percent—from 6,764,934 short tons in 1948 to 5,584,389 tons in 1949, according to the Interstate Commerce Commission. It may be noted, however, that railroad terminations of asphalt were equivalent to only 74 percent of the total apparent consumption of asphalt in the United States in 1948 and 62 percent in 1949 and that considerable quantities of asphalt were delivered to consumers by water, minor railroads, and motor trucks. Accordingly, the figures in the accompanying table do not present a complete picture of the consumption of asphalt by States.

Of the total deliveries by rail, 56 percent in 1948 and 52 percent in 1949 were set down in the populous area north of the Ohio and Potomac Rivers and east of the Mississippi River, although this area comprises only 14 percent of the area of continental United States. In this area terminations of asphalt were 23 percent lower in 1949 than in 1948. In the States south of the Potomac and Ohio and east of the Mississippi, deliveries of asphalt were 16 percent less in 1949 than in

1948. Between the Mississippi River and the Rocky Mountains, railroad terminations of asphalt were 2 percent less in 1949 than in 1948; the largest decreases were in Texas and Missouri.

Increased deliveries of asphalt in Minnesota, Louisiana, Oklahoma, and North Dakota contrasted with the general regional decline in asphalt terminations. In the Rocky Mountain States receipts of asphalt by rail were 14 percent lower in 1949 than in 1948. In the three Pacific States rail deliveries of asphalt were 16 percent lower in 1949 than in 1948.

Asphalt (natural, byproduct, and petroleum) terminated by class I railroads in the United States, 1948–49, by States, in short tons

[Interstate Commerce Commission, Freight Commodity Statistics]

Region and State	1948	(Preliminary) 1949	Region and State	1948	(Preliminary) 1949
New England	158,518	158,386	East South Central:		
Middle Atlantic:			Kentucky	114,345	131,380
New York	267,246	208,846	Tennessee	226,837	146,905
New Jersey	69,820	31,913	Alabama	72,378	74,964
Pennsylvania	804,884	529,653	Mississippi	45,044	37,041
Total	1,141,950	770,412	Total	458,604	390,290
East North Central:			West South Central:		
Ohio	1,065,879	763,144	Arkansas	74,505	55,996
Indiana	254,247	203,671	Louisiana	175,980	202,728
Illinois	613,008	497,328	Oklahoma	21,046	42,982
Michigan	237,597	228,090	Texas	152,351	112,849
Wisconsin	273,392	253,374	Total	423,882	414,555
Total	2,434,123	1,945,607	Mountain:		
West North Central:			Montana	29,819	27,893
Minnesota	194,411	235,637	Idaho	19,955	27,283
Iowa	83,647	80,973	Wyoming	10,585	6,596
Missouri	159,552	129,096	Colorado	81,211	54,541
North Dakota	42,754	49,398	New Mexico	58,443	50,780
South Dakota	61,744	61,690	Arizona	38,068	29,681
Nebraska	99,091	67,517	Utah	25,607	26,342
Kansas	90,988	90,698	Nevada	20,020	17,820
Total	732,187	715,009	Total	283,768	242,936
South Atlantic:			Pacific:		
Delaware	16,007	8,368	Washington	81,507	59,682
Maryland	18,842	13,503	Oregon	71,028	72,816
District of Columbia	1,069	940	California	322,063	266,406
Virginia	124,178	91,112	Total	474,598	398,904
West Virginia	114,448	98,383	Total United States	6,764,994	5,584,489
North Carolina	146,111	135,995	Canada	11,477	9,169
South Carolina	86,875	82,266	Grand total	6,776,411	5,593,658
Georgia	85,798	88,707			
Florida	70,656	47,017			
Total	657,364	548,390			

FOREIGN TRADE [2]

Imports.—Imports of natural asphalt and bitumen into the United States totaled 4,857 short tons valued at $167,264 (revised figures) in 1948 and 4,109 tons valued at $87,693 in 1949. Imports of lake asphalt from Trinidad decreased from 4,667 tons valued at $97,444 in 1948 to 4,104 tons valued at $73,715 in 1949. Imports of grahamite from

[2] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Cuba decreased from 76 tons valued at $2,297 in 1948 to 73 tons valued at $2,294 in 1949.

Imports of solid petroleum asphalt decreased from 249,008 short tons valued at $1,912,522 (revised figures) in 1948 to 194,911 tons valued at $2,351,632 in 1949. Except for 21 tons valued at $827, which were imported from Canada in 1948, all of these imports came from the Netherlands Antilles.

In addition, the United States received 191,880 barrels (34,887 short tons) of liquid petroleum asphalt valued at $506,930 in 1948 and 104,808 barrels (19,056 tons) valued at $263,321 in 1949. All of the 1948 imports and most of the 1949 imports came from the Netherlands Antilles; Mexico, however, contributed 491 barrels (89 tons) valued at $11,934 in 1949.

Exports.—The tonnage of natural asphalt, unmanufactured, exported from the United States increased from 13,682 short tons valued at $559,462 in 1948 to 16,672 tons valued at $823,143 in 1949. Of the 1949 exports, 66 percent went to Europe, notably to the United Kingdom, France, Germany, Italy, Denmark, Belgium, Sweden, and Switzerland. Canada received 15 percent of the total and Mexico 4 percent.

Exports of petroleum asphalt from the United States in 1949 declined from 269,958 short tons valued at $8,984,509 in 1948. Asia contrasted with the other continents; it took 56 percent of the total exports in 1949 compared with 40 percent in 1948. Europe, which received 33 percent of the total in 1948, accounted for only 17 percent of the whole in 1949.

Smaller exports to Europe were the principal factor in the general decline. The most conspicuous decreases were in shipments to Greece, Portugal, and Spain. Of the major European countries, only Austria and Germany received more asphalt from the United States in 1949 than in 1948.

Eastern and southeastern Asia received the greater part of the asphalt exports to Asia in 1949. The greatest increases were in shipments to Japan, French Indochina, and Indonesia; less was received by Korea.

Asphalt exports to Canada and Mexico, chief customers in North America, were lower in 1949 than in 1948. In spite of decreased shipments to Uruguay, more asphalt was shipped to South America in 1949 than in 1948.

Less asphalt was shipped to Australia and New Zealand in 1949 than in 1948.

Petroleum asphalt exported from the United States, 1947–49, by countries of destination

[U. S. Department of Commerce]

Country	1947		1948		1949 [1]	
	Short tons	Value	Short tons	Value	Short tons	Value
North America:						
British Honduras	548	$21,525	866	$35,529	342	$13,454
Canada	8,207	433,039	10,768	462,199	4,790	307,332
Newfoundland	18	940	17	1,230		
Canal Zone	290	7,635	364	11,599	2,895	39,614
Cuba	345	16,375	97	6,029	168	6,837
Dominican Republic	1,195	4,118	735	19,316	237	8,469
Guatemala	2,422	50,862	1,560	37,903	713	20,710
Honduras	217	7,373	681	30,910	59	2,119
Mexico	13,058	215,476	10,278	170,871	9,706	261,656
Nicaragua	206	5,786	614	36,107	2,372	59,930
Panama	501	12,588	120	5,171	281	7,380
Other North America	622	16,780	319	11,382	374	11,445
Total North America	27,629	792,497	26,419	828,246	21,937	738,946
South America:						
Argentina	182	16,622	90	9,923	19	1,513
Bolivia	245	6,029	383	12,310	294	10,683
Brazil	23,119	687,875	5,741	200,922	10,906	413,613
Chile	4,534	135,622	588	18,821	1,112	37,034
Uruguay	2,592	79,472	5,697	193,222	2,812	80,770
Venezuela	141	4,361	894	38,748	488	20,084
Other South America	512	15,964	76	3,453	182	8,058
Total South America	31,325	945,945	13,469	477,399	15,813	571,755
Europe:						
Austria			219	9,558	13,450	406,750
Belgium-Luxembourg	18,326	455,191	5,545	203,122	2,090	142,830
Denmark	30	1,202	106	6,011	41	3,480
Finland	1,361	39,395	55	2,970		
France	177,138	4,213,682	1,072	78,783	1,698	139,379
Germany					4,016	155,706
Greece	1	54	53,106	2,508,199	15,531	398,187
Italy	83,448	2,309,958	167	14,115	837	33,706
Netherlands	231	25,662	649	35,026	537	58,018
Norway	14,452	408,970	7,756	173,969	282	14,682
Portugal	28,387	866,803	12,084	377,141	24	723
Spain	25,160	550,762	2,474	96,201	58	2,854
Sweden	10,637	276,670	561	16,377	75	5,612
Switzerland	10,939	302,923	6,004	182,286	1,065	40,576
Other Europe	907	27,814	121	6,186	8	936
Total Europe	371,017	9,479,086	89,919	3,709,944	39,712	1,403,439
Asia:						
Ceylon	407	8,830	933	24,779	2,629	63,295
China	11,591	207,588	3,889	110,080	22	946
French Indochina	1,859	40,442	12,737	363,082	32,165	835,504
Hong Kong	672	18,470	3,529	115,310	1,168	39,221
India and Pakistan	12,627	292,188	2,718	92,853	152	4,971
Indonesia	15,838	424,138	29,910	831,716	30,068	1,016,910
Japan			1,645	56,192	22,509	593,045
Korea	5,704	148,400	18,969	564,675	12,149	402,754
Lebanon					1,136	38,773
Malaya, Federation of	8,416	206,996	5,135	155,922	2,150	68,609
Philippines	10,649	226,211	24,976	594,975	23,348	679,380
Saudi Arabia	2,963	90,525	2,819	72,709	6	237
Thailand	519	11,232	1,604	58,343	1,376	29,916
Turkey	167	5,383	10	1,356	3,438	95,855
Other Asia	109	3,284	255	9,409	10	1,032
Total Asia	71,511	1,683,677	109,119	3,041,401	132,326	3,870,448

See footnote at end of table.

Petroleum asphalt exported from the United States, 1947–49, by countries of destination—Continued

Country	1947		1948		1949 [1]	
	Short tons	Value	Short tons	Value	Short tons	Value
Africa:						
Algeria	2,513	$79,125			743	$65,758
Belgian Congo	110	6,335	256	$12,421	2,266	82,112
Ethiopia					1,935	72,139
French Morocco			959	76,208	178	15,481
French West Africa	1,260	47,272	4,419	189,737	3,929	111,251
Mozambique	2,389	47,591	5,460	125,926	1,851	39,451
Tunisia					267	23,969
Union of South Africa	17,715	409,136	15,438	406,728	10,591	306,122
Other Africa	974	26,335	80	4,337	1,556	51,454
Total Africa	24,961	615,794	26,612	815,357	23,316	767,737
Oceania:						
Australia	14,014	359,985	2,011	59,546	930	38,101
New Zealand	15,372	327,938	2,409	52,616	38	1,568
Other Oceania	120	3,041			384	10,168
Total Oceania	29,506	690,964	4,420	112,162	1,352	49,837
Grand total	555,949	14,207,963	269,958	8,984,509	234,456	7,402,162

[1] Data shown are for "petroleum asphalt, unmanufactured." In addition, exports of "petroleum asphalt manufactures" were valued at $321,252 (quantity not available); not separately classified in earlier years.

ROAD OIL

Sales of road oil by petroleum refineries in the United States increased 11 percent in quantity—from 6,115,000 barrels in 1948 to 6,768,000 barrels in 1949—but, because of lower prices declined 2 percent in value—from $17,870,000 in 1948 to $17,485,000 in 1949. The increase in quantity was due principally to greater sales in California and in the Oklahoma-Kansas-Missouri district. Four refining districts—Indiana-Illinois-Kentucky, etc., Oklahoma-Kansas-Missouri, Rocky Mountains, and California—together made 95 percent of all the road-oil sales in 1948 and 97 percent in 1949.

Of the total sales of road oil to domestic consumers, 186,489 barrels valued at $698,172 in 1948 and 97,207 barrels valued at $397,074 in 1949 were made from foreign petroleum, imported chiefly from Venezuela, Colombia, and Mexico.

Production, receipts, stocks, consumption, transfers, losses, exports, and domestic sales of road oil in the United States in 1949, by districts, in thousands of barrels

District	Production	Receipts[1]	Stocks		Consumption by producers, transfers, losses, and exports	Sales to domestic consumers
			Jan. 1	Dec. 31		
East Coast	122	75	32	10	113	106
Appalachian	2	11			1	12
Indiana, Illinois, Kentucky, etc	1,651	28	72	35	380	1,336
Oklahoma, Kansas, and Missouri	660	584	7	10	112	1,129
Texas	59	41	3	1	3	99
Louisiana-Arkansas	13	6	6	5	14	6
Rocky Mountain	1,637	330	128	101	620	1,374
California	3,547		253	204	890	2,706
Total: 1949	7,691	1,075	501	366	2,133	6,768
1948	7,915	1,057	613	501	2,969	6,115

[1] Receipts from interindustry refinery transfers, imports, and transfers from stocks formerly not classed road oil.

Road oil sold by petroleum refineries to domestic consumers in the United States 1948–49, by districts

District	1948		1949	
	Thousand barrels	Thousand dollars	Thousand barrels	Thousand dollars
East coast	193	725	106	432
Appalachian			12	36
Indiana, Illinois, Kentucky, etc	1,900	5,670	1,336	3,555
Oklahoma, Kansas, and Missouri	919	2,459	1,129	2,828
Texas	106	363	99	313
Louisiana-Arkansas	8	25	6	18
Rocky Mountain	1,347	3,836	1,374	3,492
California	1,642	4,792	2,706	6,811
Total	6,115	17,870	6,768	17,485

Barite

By Joseph C. Arundale and F. M. Barsigian

GENERAL SUMMARY

DOMESTIC production and consumption of barite declined in 1949. Arkansas remained the leading producer with almost half of the total—nearly twice that of the next State, Missouri. New production was reported from New Mexico and South Carolina. Well drilling again took the major portion of the barite consumed. There was a sharp decrease in the tonnage consumed in lithopone. Trade-journal price quotations remained generally constant. Crude barite was imported from Canada, Yugoslavia, Italy, and Mexico, but total tonnage was the lowest in several years. The operations of Canadian Industrial Minerals, Ltd., near Walton, Nova Scotia, were discontinued temporarily in December. A large new deposit of barite was discovered in the Republic of the Philippines.

Salient statistics of the barite and barium-chemical industries in the United States, 1945–49

	1945	1946	1947	1948	1949
Barite:					
Primary:					
Produced .... short tons	692,330	725,223	884,219	777,841	731,308
Sold or used by producers:					
Short tons	696,062	724,362	834,082	799,848	717,313
Value	$5,348,652	$5,242,755	$6,171,342	$6,693,413	$5,642,226
Imports for consumption:					
Short tons	56,894	44,662	53,222	53,204	26,178
Value	$382,611	$274,267	$378,294	$443,515	$192,567
Consumption .... short tons	720,903	722,073	835,818	894,309	719,543
Ground and crushed sold by producers:					
Short tons	468,939	455,240	549,965	631,424	554,028
Value	$7,519,759	$7,208,193	$8,979,400	$11,195,365	$10,156,590
Barium chemicals sold by producers:					
Short tons	68,084	80,871	72,919	71,717	56,792
Value	$6,493,448	$7,003,756	$7,035,104	$7,028,058	$5,646,403
Lithopone sold or used by producers:					
Short tons	136,161	147,001	165,024	140,033	78,335
Value	$10,645,316	$11,840,596	$17,382,592	$16,135,976	$8,977,178

A petition was made to the Interstate Commerce Commission for reopening hearings on rail rates on barite.

Hearings were held simultaneously by the Tariff Commission and the Committee for Reciprocity Information to receive industry views on commodities to be included in negotiations at the trade agreements conferences. At these hearings, industry representatives testified in opposition to further tariff reductions on ground barite.[1]

A general report was published describing the occurrences of barite, mining, prospecting, marketing methods, and uses.[2]

[1] Oil, Paint and Drug Reporter, vol. 155, No. 5, Jan. 31, 1949, pp. 3, 78.
[2] Winston, W. B., Barium: California Jour. Mines and Geol., vol. 45, No. 1, January 1949, pp. 85–97.

DOMESTIC PRODUCTION

The 731,308 short tons of primary barite[3] reported by domestic producers in 1949 was the third greatest annual output on record, being surpassed only in 1947 and 1948.

Arkansas, the leading State, produced almost half of the United States total and nearly twice as much as the second State, Missouri. Georgia and Tennessee production continued to decrease rapidly. New production was reported from New Mexico and South Carolina.

Domestic barite sold or used by producers in the United States, 1947–49, by States

State	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Arkansas[1]	376,017	$2,390,643	362,470	$2,899,760	363,382	$2,907,056
Georgia	61,202	639,865	62,781	654,959	50,267	465,325
Missouri	291,619	2,405,249	278,071	2,413,802	186,891	1,497,985
Nevada	37,388	261,168	(2)	(2)	70,576	416,416
Tennessee	31,476	285,853	25,818	275,242	13,376	137,120
Other States[3]	36,380	188,564	70,708	449,650	32,821	218,324
Total	834,082	6,171,342	799,848	6,693,413	717,313	5,642,226

[1] Value estimated.
[2] Included with "Other States."
[3] 1947: Arizona and California; 1948: Arizona, California, and Nevada; 1949: Arizona, California, Idaho, New Mexico, and South Carolina.

Ground (and crushed) barite produced and sold by producers in the United States, 1945–49

Year	Plants	Production (short tons)	Sales	
			Short tons	Value
1945	20	473,749	468,939	$7,519,759
1946	23	456,327	456,246	7,208,193
1947	23	552,227	549,965	8,979,400
1948	23	630,808	631,424	11,196,365
1949	24	561,258	554,028	10,156,590

Arizona.—The Arizona Barite Co. continued to operate its mine and mill near Mesa, producing ground barite for the well-drilling trade.

Arkansas.—The two firms in Arkansas—Magnet Cove Barium Corp. and Baroid Sales Division of National Lead Co.—produced ground barite at their mines and plants near Malvern for use in well drilling. Near the end of 1949 it was announced that Dresser Industries, Inc., Cleveland, Ohio, would acquire the common stock of Magnet Cove Barium Corp., and continue the production of well-drilling compounds.[4]

[3] The term "primary barite," as used in this chapter, applies to barite as first offered to the trade, whether lump, crushed, or ground. Where ground barite has been reported to the Bureau of Mines as original production, an estimate of the value of the lump equivalent of the ground has been assigned to such tonnage.
[4] Oil, Paint and Drug Reporter, vol. 156, No. 20, Nov. 14, 1949, p. 41.

California.—Crude barite from the mine of Baroid Sales Division of National Lead Co., near El Portal, Calif., was ground in its plant at Merced.

Georgia.—The barite deposits in the Cartersville district, northwestern Georgia, were described.[5] New Riverside Ochre Co. and Paga Mining Co. continued to produce near Cartersville. B. R. Cain reported cessation of operations at his mine near Cartersville in 1949. Operators in this area report severe competition from imported barite.

Idaho.—J. R. Simplot Co. produced crude barite from the Sun Valley Barite mine near Hailey, Idaho, and ground this material at its plant at Pocatello for well-drilling use.

Kentucky.—Deposits of mixed barite and fluorspar of widely varying composition occurring in Kentucky are mined and sold to the glass industry as a flux. One commercial product analyzes about 40 percent $BaSO_4$ and 60 percent CaF_2.[6] This production is not considered in the barite statistics but is included in the fluorspar statistics.

Missouri.—Many Missouri producers were inactive during a part of 1949 as a result of the slack demand for barite.

Nevada.—Several new producers in Nevada reported shipments of barite during the year.

New Mexico.—It was reported that the Royal Flush mine in the Hansonberg district of Socorro County, N. Mex., was sold to Erwin & Bishop of Houston, Tex., who plan to build a barite cleaning, grinding, and sacking plant near San Antonio, N. Mex., south of Socorro.[7]

Mudrite Chemical Corp. temporarily ceased operations at its mine near Hatch and plant at Rincon on April 30.

Discovery of a deposit of barite near Albuquerque was reported.[8]

South Carolina.—Industrial Minerals, Inc., purchased the properties of Cherokee Chemical Co., at Kings Creek, S. C. The plant at this property was formerly operated under lease by the Clinchfield Sand & Feldspar Corp. Local barite ore will be utilized instead of ore from Tennessee which was formerly processed in this plant.

Tennessee.—Operations of the Clinchfield Sand & Feldspar Corp. near Del Rio, Tenn., were discontinued in January.

The Bureau of Mines issued a report on the results of a diamond-drilling project on three properties in eastern Tennessee and western North Carolina conducted during 1944 as a part of the strategic minerals program.[9]

CONSUMPTION AND USES

The consumption of barite in the United States in 1949 was reported as follows (1948 in parentheses): For well drilling, 494,579 short tons

[5] Kesler, Thomas L., Occurrence and Exploration of Barite Deposits at Cartersville, Ga.: Min. Eng., vol. 1, No. 10, October 1949, Trans. Am. Inst. Min. and Met. Eng., vol. 184, 1949, pp. 371–75.

[6] Ceramic Industry, vol. 52, No. 1, January 1949, p. 107.

[7] Engineering and Mining Journal, vol. 150, No. 6, June 1949, p. 116.

[8] Engineering and Mining Journal, vol. 150, No. 4, April 1949, p. 127.

[9] Dahners, Laurence A., Investigation of the Del Rio and Stackhouse Barite Deposit, Cocke County, Tenn., and Madison County, N. C.: Bureau of Mines, Rept. of Investigations, 4571, 1949, 26 pp.

(565,249); for lithopone, 71,710 (153,987); for chemicals, 80,584 (100,038); for glass, 21,768 (23,580); for paint filler, 20,000 (22,000); for rubber filler, 14,000 (18,000); and for other purposes, including grinding losses, 16,902 (11,455); total, 719,543 (894,309). These figures include both foreign and domestic barite.

Total barite consumed in the United States during 1949 was the lowest in several years. The bulk of the ground barite was used in well-drilling muds. In recent years many new records have been set in the depths to which oil wells are drilled, and the average depth of wells drilled is increasing steadily. Such a situation requires more and improved drilling muds in which ground barite is used principally as a weighting agent.

The greatest decrease in consumption was in lithopone. Titanium dioxide is replacing a large part of the lithopone as a white pigment in paints and other products.

Numerous new barium compounds and new uses for barium compounds are being developed. Among these are barium phenolate, a chemical starting point in the manufacture of plasticizers,[10] barium compounds sprayed on the cathode of voltage regulation tubes,[11] the use of radioactive barium isotopes in tracing of fluid flow through pipes,[12] and barium stearates.[13]

Crude barite (domestic and imported) used in the manufacture of ground barite and barium chemicals in the United States, 1945–49, in short tons

Year	In manufacture of—			Total	Year	In manufacture of—			Total
	Ground barite [1]	Lithopone	Barium chemicals			Ground barite [1]	Lithopone	Barium chemicals	
1945	482,442	139,288	99,173	720,903	1948	640,284	153,987	100,038	894,309
1946	465,468	154,166	102,439	722,073	1949	567,249	71,710	80,584	719,543
1947	561,230	167,321	107,267	835,818					

[1] Includes some crushed barite.

Ground (and crushed) barite sold by producers, 1947–49, by consuming industries

Industry	1947		1948		1949	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Well drilling	467,350	85	565,249	90	494,579	89
Glass	33,641	6	23,580	4	21,768	4
Paint	29,000	5	22,000	3	20,000	4
Rubber	17,000	3	18,000	3	14,000	2
Undistributed	2,974	1	2,595	(1)	3,681	1
Total	549,965	100	631,424	100	554,028	100

[1] Less than 0.5 percent.

[10] Oil, Paint and Drug Reporter, vol. 156, No. 20, Nov. 14, 1949, p. 55.
[11] Aminco Laboratory News, vol. 6, No. 4, July 1949, p. 7.
[12] Aminco Laboratory News, vol. 6, No. 4, July 1949, p. 8.
[13] Chemical Industries, vol. 65, No. 1, July 1949, p. 147.

A considerable interest in the compound barium titanate and its dielectric and electrostrictive properties was expressed and a number of interesting articles[14] and patents[15] dealing with the properties, preparation, and uses of this compound have been published in recent years.

Lithopone sold or used by producers in the United States, 1945–49

	1945	1946	1947	1948	1949
Plants	8	8	8	8	8
Short tons	136,161	147,001	165,024	140,033	78,335
Value	$10,645,316	$11,840,596	$17,382,592	$16,135,976	$8,977,178

Distribution of lithopone shipments, by industries, 1947–49, in short tons

Industry	1947		1948		1949	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Paints, varnishes, and lacquers [1]	134,830	82	104,441	75	56,146	78
Floor coverings	9,048	6	12,423	9	6,380	8
Coated fabrics and textiles	8,421	5	8,436	6	6,602	3
Paper	4,069	2	4,814	3	2,375	4
Rubber	3,085	2	4,192	3	3,245	5
Other	5,571	3	5,727	4	3,587	2
Total	165,024	100	140,033	100	78,335	100

[1] Includes a quantity, not separable, used for printing ink.

[14] Journal, American Ceramic Society, vol. 32, No. 10, Oct. 1, 1949, pp. 242–243. De Bretteville, A., Jr., Physics of Ferroelectric Barium Titanate: Ceram. Age, vol. 54, No. 6, December 1949, pp. 363–379.

[15] Journal, American Ceramic Society, vol. 32, No. 8, Aug. 1, 1949, p. 188, and vol. 32, No. 10, Oct. 1, 1949, p. 236.

Barium chemicals produced and used or sold by producers in the United States, 1945–49, in short tons

Chemical	Plants	Produced	Used by producers [1] in other barium chemicals [2]	Sold by producers [3]	
				Short tons	Value
Black ash: [4]					
1945	15	149,871	149,203	257	$10,490
1946	15	163,131	162,889	505	22,876
1947	15	173,385	172,987	248	15,888
1948	16	152,383	151,509	459	31,442
1949	15	97,693	97,753	246	16,464
Carbonate (synthetic):					
1945	5	40,689	25,139	15,287	905,402
1946	5	43,611	21,569	21,700	1,313,233
1947	5	46,761	20,767	25,985	1,739,144
1948	5	43,227	16,588	27,482	1,927,599
1949	4	36,122	10,077	27,010	1,942,845
Chloride (100 percent basis):					
1945	3	14,766	4,743	9,562	831,072
1946	3	16,037	4,974	10,821	927,155
1947	4	14,133	3,984	9,867	986,968
1948	4	14,244	4,432	8,998	964,311
1949	3	11,604	3,739	7,549	848,637
Hydroxide:					
1945	3	2,334	123	2,135	242,124
1946	3	3,024	585	2,503	320,474
1947	4	5,774	568	4,910	787,711
1948	4	5,030	92	4,849	809,589
1949	4	3,849	140	3,737	694,097
Oxide:					
1945	3	6,253	5,965	260	52,057
1946	3	6,507	6,105	375	64,522
1947	3	7,318	6,865	378	74,320
1948	3	7,247	6,449	577	127,716
1949	3	5,795	4,899	1,118	233,733
Sulfate (synthetic):					
1945	8	30,822	17,602	12,856	922,902
1946	8	34,171	16,956	18,791	1,330,651
1947	8	27,353	10,980	16,086	1,302,869
1948	7	22,733	(5)	(5)	(5)
1949	7	15,182	------------	15,371	1,436,557
Other barium chemicals: [6]					
1945	(7)	36,428	4,405	27,727	3,529,401
1946	(7)	28,880	4,395	26,176	3,024,845
1947	(7)	21,107	4,092	15,445	2,128,214
1948	(7)	13,469	[8] 15,443	[8] 28,352	[8] 3,167,401
1949	(7)	5,320	2,890	1,761	474,070
Total: [9]					
1945	19	------------	------------	68,084	6,493,448
1946	19	------------	------------	80,871	7,003,756
1947	20	------------	------------	72,919	7,035,104
1948	20	------------	------------	71,717	7,028,058
1949	20	------------	------------	56,792	5,646,403

[1] Of any barium chemical.
[2] Includes purchased material.
[3] Exclusive of purchased material and exclusive of sales by one producer to another.
[4] Black-ash data include lithopone plants.
[5] Included with "Other barium chemicals."
[6] Consists mostly of titanium dioxide-barium sulfate pigments (except 1949), with small quantities of barium acetate, chromate, nitrate, perchlorate, peroxide, and sulfide. Specific chemicals may not be revealed by specific years.
[7] Plants included in above figures.
[8] Also includes barium sulfate (synthetic).
[9] A plant producing more than 1 product is counted but once in arriving at grand totals.

PRICES

Trade-journal price quotations for crude and ground barite, witherite, and barium chemicals remained generally constant during 1949.

Crude.—The December 8, 1949, issue of E&MJ Metal and Mineral Markets quoted the following prices for crude barite, f. o. b. mines: Georgia, crude, $11.50–$12.00 per long ton; Missouri, crude, minimum

94 percent $BaSO_4$, less than 1 percent iron, $9.50 per short ton; 93 percent $BaSO_4$, $9.00–$9.25, f. o. b. mines.

Ground.—In December the price of water-ground barite in paper bags, carlots, St. Louis, remained at $35.05 per short ton the same as in 1948, according to Oil, Paint and Drug Reporter. Well-drilling grades of ground barite averaged $17.41 a short ton, bulk, f. o. b. mine, according to reports of grinders to the Bureau of Mines.

Witherite.—Witherite (barium carbonate) was quoted in 1949 at $65 per short ton, air-floated, carlots (the same as in 1948); $72–$73 on less than a carload.

Range of quotations on barium chemicals in 1949

[Oil, Paint and Drug Reporter]

Barium carbonate, precipitated, bags, 10 tons and up, works	short ton	$72.50 –$80.00
Barium chlorate, kegs, works	pound	.25½– .31
Barium chloride, technical, bags, carlots, works, freight equaled	short ton	90.00
Barium chromate, bags, freight equaled	pound	.31½– .32
Barium dioxide (peroxide), drums, carlots, works	do	.12
Barium hydrate, crystals, bags	do	.09 – .09½
Barium nitrate, barrels, carlots, works	do	.11½
Barium oxide, ground, drums, carlots, works	do	.11
Blanc fixe (dry):		
Direct process, bags, carlots, works	short ton	85.00
Byproduct, bags, carlots, works	do	77.50
Lithopone: [1]		
Ordinary, bags, carlots, shipping point	pound	.06¼– .06⅜
Less carlots, same basis	do	.06½ .06¾
Titanated (high-strength), bags, carlots, shipping point	do	.08¼
Smaller lots	do	.08½

[1] Pacific coast prices on lithopone ¼ cent per pound higher.

FOREIGN TRADE [16]

Barite.—Imports of crude barite were the lowest in several years. Canada remained the leading source, but tonnages shipped were

Barite imported for consumption in the United States, 1945–49, by countries

[U. S. Department of Commerce]

	1945		1946		1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Crude barite:										
Canada	49,497	$327,242	44,109	$268,839	48,364	$355,349	39,877	$359,161	8,813	$60,429
Cuba	2,307	29,417								
Italy					2	40	5,601	51,257	5,712	65,024
Mexico	5,100	25,952	553	5,428	4,856	22,985	7,726	33,097	3,589	9,516
Yugoslavia									8,064	57,598
Total crude barite	56,904	382,611	44,662	274,267	53,222	378,374	53,204	443,515	26,178	192,567
Ground barite:										
Canada	1	15								
Greece							(1)	11	211	2,241
Total ground barite	1	15					(1)	11	211	2,241

[1] Less than 1 ton.

[16] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

sharply reduced owing to the lack of markets. Yugoslavia shipped a large tonnage for the first time. Crude barite was also imported from Italy and Mexico and a small tonnage of ground barite from Greece.

As of October 5, 1949, Great Britain relaxed import-licensing restrictions on barite. The relaxation took the form of Open General Licenses permitting anyone to import goods without the need of an import license from any country other than the dollar-account countries.

Witherite.—All imports of witherite came from Great Britain.

Witherite, crude, unground, imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons	Value [1]	Year	Short tons	Value [1]
1945	896	$26,736	1948	2,470	$94,809
1946	1,107	31,599	1949	2,113	63,369
1947	739	25,757			

[1] Valued at port of shipment.

Barium Chemicals.—The demand for lithopone for export slumped considerably. As in the past, imports of barium chemicals amounted to only a few thousand dollars.

Barium chemicals imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Lithopone		Blanc fixe (precipitated barium sulfate)		Barium chloride	
	Pounds	Value	Short tons	Value	Pounds	Value
1945	75	$7				
1946	1,000	58				
1947	112	21				
1948						
1949	24,003	2,053	1	$54	8	$8

Year	Barium nitrate		Barium hydroxide		Other barium compounds	
	Short tons	Value	Short tons	Value	Short tons	Value
1945			35	$3,691		
1946						
1947	66	$9,511			6	$1,916
1948	141	17,492			11	3,771
1949	84	7,819			11	5,651

Lithopone exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons	Value: Total	Value: Average	Year	Short tons	Value: Total	Value: Average
1945	11,576	$1,049,961	$90.70	1948	21,615	[illegible]	[illegible]
1946	9,651	888,565	92.07	1949	[illegible]	[illegible]	[illegible]
1947	13,052	1,784,414	136.71				

TECHNOLOGY

A report summarized results of the ore-dressing studies and field geology investigation of the Carolina barite belt carried on by the North Carolina Department of Conservation and Development, the South Carolina Research, Planning, and Development Board, and the Regional Minerals Section of the TVA Division of Chemical Engineering.[17]

WORLD REVIEW

Argentina.—Barite mining and processing was declared "of national interest" by the Argentine Government. Accordingly, all imports of the mineral will be under Government control. Barite mining and processing, begun in that country in 1949, was developed during the war years to prove that domestic ore will be adequate to satisfy national consumption.[18]

World production of barite, by countries, 1944–49, in metric tons [1]

[Compiled by Helen L. Hunt]

Country [1]	1944	1945	1946	1947	1948	1949
Algeria	1,340	2,770	14,240	23,692	16,681	16,874
Argentina	14,405	8,585	10,000	[2] 35,000	(3)	(3)
Australia	4,487	3,502	7,711	5,500	3,831	(3)
Austria	(3)	(3)	808	2,007	3,842	8,135
Belgium	300	-	(3)	-	(3)	(3)
Brazil	282	617	10,326	13,971	[2] 10,000	(3)
Canada	107,700	126,632	109,242	116,731	86,860	36,029
Chile	1,606	3,097	3,752	2,546	2,141	(3)
Colombia	(3)	(3)	(3)	[2] 2,800	120	(3)
Cuba (exports)	8,219	2,094	-	-	-	(3)
Egypt	59	54	-	167	-	30
France	9,575	13,795	34,570	53,970	(3)	(3)
Germany	[2] 330,000	(3)	[4] 45,736	[5] 35,000	[5] 41,000	183,457
Greece	-	-	-	-	18,706	15,604
India	15,545	25,051	29,558	24,700	22,691	(3)
Ireland	10,519	16,714	13,557	12,927	7,112	(3)
Israel and Jordan	-	23	3	(3)	(3)	(3)
Italy	24,163	11,935	24,861	68,736	62,234	46,616
Japan	[6] 12,049	[6] 7,540	581	907	3,404	9,322
Korea:						
Northern	5,640		[2] 100	[2] 1,000	(3)	(3)
Southern		-	-	-	-	(3)
Peru	2,352	4,240	7,187	6,560	(3)	(3)
Portugal	70	290	294	1,211	406	(3)
South-West Africa	-	-	-	-	-	48
Southern Rhodesia	14	-	173	18	51	488
Spain	7,491	9,877	12,245	19,817	14,153	(3)
Swaziland	-	79	224	172	98	104
Sweden	-	1,250	505	1,319	1,914	(3)
Switzerland	233	-	-	-	-	(3)
Tunisia	76	68	408	470	230	630
Union of South Africa	3,201	2,222	2,326	2,672	1,734	2,222
United Kingdom [7]	100,422	94,711	112,705	96,267	(3)	(3)
United States	467,321	628,068	657,908	802,146	705,642	663,428
Total [8]	1,130,000	1,165,000	1,155,000	1,395,000	1,320,000	1,255,000

[1] In addition to countries listed, barite is produced in China, Czechoslovakia, Mexico, Norway, U. S. S. R., and Yugoslavia, but data on production are not available.
[2] Estimate.
[3] Data not available; estimate by author of chapter included in total.
[4] Excludes British zone.
[5] Excludes British, French, and Soviet zones.
[6] Preliminary data for the fiscal year ended March 31 of year following that stated.
[7] Includes witherite.
[8] Estimated by author of chapter; excludes estimates for countries listed in footnotes 1, 4, and 5.

[17] Van Horn, R. C., LeGrand, J. R., and McMurray, L. L., Geology and Preliminary Ore Dressing Studies of the Carolina Barite Belt: North Carolina Dept. of Conservation and Development, Bull. 57, 1949, 25 pp.
[18] Engineering and Mining Journal, vol. 150, No. 2, February 1949, p. 168.

Brazil.—The barite deposits of Camamu Bay, Brazil, were described.[19]

Early in 1948, the management of the barite operations of the Pigmentos Minerals Industrial e Comercial Pigmina, S. A., on the island of Camamu, Baia, were taken over by a firm in Rio de Janeiro, and the name of the concern was changed to Antiles Minerals.[20]

Canada (Nova Scotia).—According to the American consulate at Halifax, the barite activity at Walton, in common with many other Canadian mining industries, experienced a mild business recession during midsummer of 1949, but operations soon returned to normal. The proven ore reserves are reported to approximate 1,600,000 long tons, and a heavy development program in progress is expected to augment these reserves. The company continued to reduce operating costs.

Progress made by Maritime-Barytes, Ltd., in establishing a plant at Brookfield for the production of high-grade white, as well as oil-grade, has been confined to revision of flow-sheet plans and preparations for plant construction expected to go forward in the spring of 1950.

Of various developments affecting mining activities in Nova Scotia, probably the most important was devaluation of the Canadian dollar and other currencies in mid-September. The barite industry, an export business in this Province, had been hard hit earlier in the year by slumping sales owing to complex market conditions, and the effect of dollar shortage abroad and greater devaluation by other producing countries was to close operations in the Province entirely.[21]

Barite deposits and operations in Nova Scotia were described in detail.[22]

France.—There are barite deposits in more than 30 Departments in France. For a long time, the two Departments with the most important production have been Lozère and Hérault. In the Basses-Pyrénées, use is being made of the deposit at Bidarray, where the mineral is of superior quality, containing less than 2 percent silica.[23]

Germany.—The war-damaged Hartenrod mine at Herborn, Baden, has been rehabilitated, and the Rhine River & Barite Works has resumed producing barite at the rate of 50 tons monthly. Before the war, this mine yielded approximately 2,000 tons each month, which found a market in the chemical, paint, and paper industries.[24]

The Barite mine at Muenden and the mill at Sontra, Hesse, of Deutsche Baryt-Industrie have ceased operations owing to lack of demand.[25]

Philippines.—A large barite deposit was discovered in the Province of Batangas. The ore appears to be high grade. Development is still in the exploration stage.[26]

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[19] Bodenlos, A. J., Barite Deposits of Camamu Bay, State of Bahia, Brazil: U. S. Geol. Survey Bull. 960–A, 1949, pp. 1–33.
[20] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 5, November 1949, p. 25.
[21] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 2, February 1950, pp. 28–29.
[22] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 3, September 1949, pp. 28–40.
[23] Chemistry & Industry, No. 7, Feb. 12, 1949, p. 105.
[24] Mining World, vol. 11, No. 3, March 1949, p. 50.
[25] Mining World, vol. 11, No. 9, August 1949, p. 49.
[26] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 6, December 1949, p. 23.

Bauxite

By Richard H. Mote and Horace F. Kurtz

GENERAL SUMMARY

UNITED STATES, mine production of crude bauxite during 1949 totaled 1,352,495 long tons (1,148,792 tons, dried equivalent), a decrease of 22 percent from 1948. Curtailed operations during the second and third quarters and a work stoppage by one strike-bound producer reduced annual output to the lowest level since 1946. Arkansas mines produced nearly all of the domestic bauxite in 1949.

Imports constituted a larger proportion of the total supply than in previous years and even increased in tonnage in 1949, despite a decline in total bauxite consumption. Surinam supplied 75 percent of the imports (82 percent in 1948), but receipts from Indonesia represented the largest gain. For the sixth consecutive year exports of bauxite and concentrates, largely to Canada, decreased.

Domestic consumption of bauxite in 1949 was 2,667,043 tons (dried equivalent), slightly below 1948. Of this quantity, 86 percent was used at alumina plants. The prices for most grades of bauxite were changed little from 1948.

Stocks of crude bauxite declined during 1949, but those of bauxite already processed and ready for use accumulated at most producers' and consumers' plants. The War Assets Administration stockpile in Arkansas remained unchanged at 2,785,527 tons throughout 1949. Bauxite stocks in the National Stockpile were not disclosed.

Salient statistics of the bauxite industry in the United States, 1940–44 (average), and 1945–49

	1940–44 (average)	1945	1946	1947	1948	1949
Crude ore production (dried equivalent) .... long tons	2,606,980	981,009	1,104,054	1,202,055	1,457,148	1,148,792
Value of production	$12,894,650	$5,591,084	$6,892,864	$6,884,666	$8,696,708	$6,778,181
Imports (as shipped) .... long tons	947,726	739,581	852,005	1,821,580	2,488,915	2,688,164
Exports (as shipped) .... do	298,217	126,077	97,788	94,369	54,113	34,902
World production (as shipped) .... long tons	7,839,000	3,427,000	4,376,000	6,151,000	8,204,000	8,133,000

World output of bauxite was estimated at 8,133,000 long tons in 1949, compared with 8,204,000 tons (revised) in 1948. United States and the Guianas, principal producers in the Western Hemisphere, mined 61 percent of the 1949 total.

Aluminum metal is discussed in the Aluminum chapter of this volume.

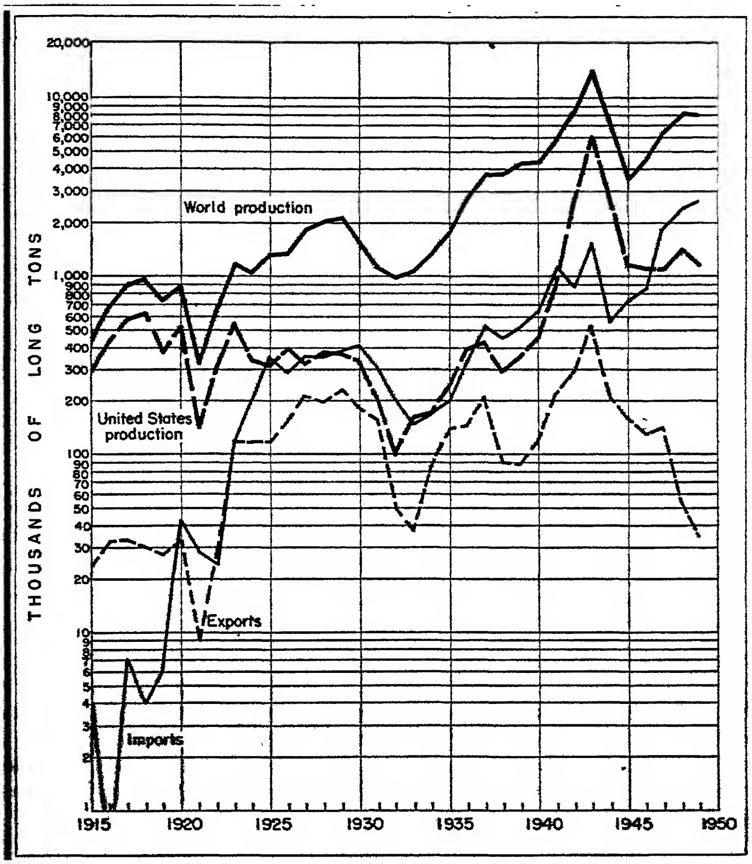

FIGURE 1.—Trends in domestic production, imports, exports, and world production of bauxite, 1915–49.

RESERVES

The Bureau of Mines and Geological Survey estimated[1] reserves of domestic bauxite at 36,341,000 long tons in 1944. This represented all deposits (measured or indicated) 8 feet or more in thickness in which the material did not exceed 15 percent SiO_2 or 6 percent FeO but did contain at least 40 percent Al_2O_3 recoverable bauxite on a mined and dried basis. These limits of analysis were the theoretical extremes for bauxite to be used in the production of alumina by wartime modifications of the Bayer process. Deduction of the quantity mined during the past 5 years reduced the total reserves to about 30,450,000 tons. The alumina plant at Hurricane Creek, Ark., is capable of processing bauxite of greater iron content than was included in the original estimate, and this fact may permit an increase

[1] Investigations of Natural Resources, Hearings Before a Subcommittee of the Committee on Public Lands, United States Senate, 80th Cong., 1st sess., 1947, pp. [illegible].

in the reserve figure. Results of experimental work to utilize low-grade bauxites for alumina production were published during 1949.[2]

DOMESTIC PRODUCTION

Domestic mine production of crude bauxite in 1949 declined 22 percent to 1,352,495 long tons (1,148,792 tons, dried equivalent). The decrease was attributed to a labor strike at the largest producer, a smaller demand from the aluminum industry resulting from reduced metal output, and the competition of higher-grade foreign ores. Bauxite production from mines in Alabama, Arkansas, and Georgia declined 23, 22, and 4 percent, respectively; Arkansas supplied 95 percent of the total output.

Production of bauxite in the United States by quarter years,[1] 1947–49, in long tons (dried equivalent)

Months	1947	1948	1949
January-March	323,180	295,488	320,157
April-June	301,561	359,284	294,023
July-September	282,665	437,457	208,926
October-December	294,649	364,919	325,686
Total	1,202,055	1,457,148	1,148,792

[1] Figures adjusted to final annual totals.

Alabama.[3]—Mines in the Eufaula district, Barbour and Henry Counties, Ala., were operated in 1949 by the Alcoa Mining Co. and the D. M. Wilson Bauxite Co. Ore produced by the Alcoa Mining Co. was dried at its plant adjacent to the mines and shipped to the chemical and refractory industries. Alabama bauxite was also processed at the activating plant of the Floridin Co., Quincy, Fla., from which it was shipped to oil-refining industries.

Arkansas.—The Alcoa Mining Co. reduced production from its mines near Bauxite, Saline County, Ark., by 15 percent in 1949 and from its smaller mining operations in Pulaski County by 6 percent. The Saline County mines were served by a drying and calcining plant from which ore was shipped in dried form, mostly to alumina but also chemical plants. In Pulaski County the Drury drying and calcining plant produced calcined bauxite for abrasives, as well as dried ore for the alumina and chemical industries.

Both the Berry-Mayhan and the Rauch Leased mines, situated in the Berger district, Pulaski County, were operated by the American Cyanamid Co. during 1949. All of the 1949 mine production, which totaled less than in 1948, together with shipments from stocks of the idle Heckler mine and purchases from another producer, were dried at the company plant near Berger. Most of the product was consumed in chemical plants, although part was used for oil refining.

[2] Ramke, S. M., Howe, G. S., Kennedy, J. S., and Kenworthy, H., Pilot-Plant Concentration of Arkansas Aluminum Ores: Bureau of Mines Rept. of Investigations 4440, 1949, 38 pp.
Conley, J. E., and Skow, M. L., Lime-Soda Sinter Process for Alumina From High-Silica Bauxites; Laboratory and Pilot-Plant Tests: Bureau of Mines Rept. of Investigations 4462, 1949, 67 pp.

[3] McCarthy, C. E., Cole, R. S., Nichols, E. F., Wilson, H., Rupper, J. A., and Thompson, M. R., McLeod [illegible] Henry Counties, Ala.: Bureau of Mines Rept. of Investigation 4521, 1949, 85 pp.

Production and shipments of crude bauxite from mines in the United States, 1945–49, by States, in long tons

State and year	Production			Shipments to processing plants, consumers, and Government stockpiles		
	Crude	Dried bauxite equivalent	Value [1]	Crude	Dried bauxite equivalent	Value
Alabama, Georgia, and Virginia:						
1945	83,326	70,960	$394,157	84,890	72,311	$395,717
1946	64,371	53,707	314,594	65,026	54,206	318,516
1947	58,418	48,492	301,128	58,418	48,492	301,128
1948	74,511	61,807	397,222	74,511	61,807	397,222
1949	65,137	53,868	344,217	56,794	47,194	303,291
Arkansas:						
1945	1,061,911	910,049	5,196,927	1,247,766	1,073,349	5,591,630
1946	1,288,764	1,050,347	6,578,270	1,282,099	1,044,939	6,546,469
1947	1,368,693	1,153,563	6,583,538	1,340,988	1,032,035	6,438,697
1948	1,649,926	1,395,341	8,299,486	1,532,697	1,295,693	7,761,679
1949	1,287,358	1,094,924	6,433,964	1,357,118	1,149,143	6,733,096
Total United States:						
1945	1,145,237	981,009	5,591,084	1,332,656	1,145,660	5,987,347
1946	1,353,135	1,104,054	6,892,864	1,347,125	1,099,145	6,864,985
1947	1,427,111	1,202,055	6,884,666	1,399,406	1,080,527	6,739,825
1948	1,724,437	1,457,148	8,696,708	1,607,208	1,357,500	8,158,901
1949	1,352,495	1,148,792	6,778,181	1,413,912	1,196,337	7,036,387

[1] Computed from selling price of bauxite shipped from mines.

Bauxite shipped from mines and processing plants in the United States, 1945–49, by States, in long tons

Year	Alabama, Georgia, and Virginia		Arkansas		Total	
	As shipped [1]	Dried bauxite equivalent	As shipped [1]	Dried bauxite equivalent	As shipped [1]	Dried bauxite equivalent
1945	77,134	80,567	988,877	991,227	1,066,011	1,071,794
1946	52,505	53,829	1,049,125	964,945	1,101,630	1,018,774
1947	50,024	51,291	1,186,726	1,108,932	1,236,750	1,160,223
1948	59,520	59,474	1,430,688	1,314,069	1,490,208	1,373,543
1949	45,792	46,407	1,232,883	1,132,330	1,278,675	1,178,737

[1] Includes crude, dried, calcined, activated, and sintered.

Recovery of processed bauxite in the United States, 1945–49, in long tons

Year	Crude ore treated	Processed bauxite recovered			
		Dried	Activated, calcined, or sintered	Total	Dried bauxite equivalent
1945	874,189	522,533	132,525	655,058	719,416
1946	708,964	426,618	111,312	537,930	597,509
1947	655,702	410,727	102,320	513,047	564,829
1948	688,898	476,921	68,800	545,721	584,856
1949	597,536	431,168	55,544	486,702	517,412

Consolidated Chemical Industries, Inc., did not mine bauxite during 1949; however, ore was transferred from existing inventories at the Bierman Tract site, Pulaski County, to the Peiser Spur concen-

trating plant in Little Rock and, after treatment, shipped to the alumina industry.

The Crouch Mining Co. produced nearly the same tonnage of bauxite from its Young mine, Saline County, in 1949 as in the preceding year. Operations at the calcining plant near Bauxite, where ore is processed for the abrasives industry, were below the 1948 level.

Output from the Pulaski County mines of the Dulin Bauxite Co. declined substantially in 1949. Bauxite, not shipped directly to consumers or other processors, is calcined mainly for abrasive manufacture at the company plant in the vicinity of Sweet Home.

The Norton mine, Saline County, remained idle throughout 1949, but the calcining plant continued to operate, using ore from another producer. All of the calcined bauxite was used for making abrasives.

At its milling, activating, and purifying plant in Berger, Pulaski County, the Porocel Corp. activated crude ore, purchased from local producers, for sale chiefly to oil refineries. The Porocel plant for impregnating activated bauxite with chemicals did not operate during 1949.

The Reynolds Mining Corp. extracted bauxite from its mines in Saline and Pulaski Counties, and, despite decreased output in both localities, remained the largest domestic producer. A 2-month strike sharply curtailed operations during the third quarter. Output from these mines was sold undried to the parent Reynolds Metals Co. and converted to alumina at the Hurricane Creek plant.

Georgia.[4]—The only production of bauxite in Georgia during 1949 came from the American Cyanamid Co. Hatton and Thigpen mines in the Andersonville district, Sumter County. All of the ore was dried in the adjacent oil-fired standard-rotary-drying plant and shipped to the chemical industry.

Bauxite shipped from mines and processing plants in the United States, 1946–49, by consuming industries, in long tons

Industry	1946		1947		1948		1949	
	As shipped[1]	Dried bauxite equivalent	As shipped[1]	Dried bauxite equivalent	As shipped[1]	Dried bauxite equivalent	As shipped[1]	Dried bauxite equivalent
Alumina	[2] 872,311	[2] 732,972	1,032,161	907,852	1,297,617	1,149,070	1,130,573	1,007,457
Chemical	109,496	109,153	91,728	91,343	102,943	102,943	80,833	80,833
Abrasive[3]	98,670	146,868	86,265	129,126	54,187	82,677	34,122	51,258
Petroleum refining, refractory,[3] and other	21,153	29,781	26,596	31,902	35,461	38,853	33,147	39,189
Total:								
Long tons	1,101,630	1,018,774	1,236,750	1,160,223	1,490,208	1,373,543	1,278,675	1,178,737
Value	$7,725,939		$8,473,704		$9,963,032		$8,545,106	

[1] Includes crude, dried, calcined, activated, and sintered.
[2] Includes 23,323 tons (28,375 dried equivalent) shipped to Office of Metals Reserve stockpile.
[3] Small quantity of bauxite shipped to makers of refractories probably included with "Abrasive."

[4] Beck, W. A., Investigation of the Irvington Bauxite District, Wilkinson County, Ga.: Bureau of Mines Rept. of Investigations 4495, 1949, 16 pp.
Beck, W. A., Investigation of the Andersonville Bauxite District, Sumter, Macon, and Schley Counties, Ga.: Bureau of Mines Rept. of Investigations 4538, 1949, 150 pp.
Beck, W. A., Investigation of the Springvale Bauxite District, Randolph County, Ga.: Bureau of Mines Rept. of Investigations 4555, 1949, 29 pp.
Lewicki, W. T., Investigation of the Hermitage Bauxite District, Bartow and Floyd Counties, Ga.: Bureau of Mines Rept. of Investigations 4577, 1949, 10 pp.

Tennessee.—No bauxite has been mined commercially in Tennessee since 1928. The Bureau of Mines has published results of a survey conducted in one area during World War II.[5]

CONSUMPTION AND USES

Consumption of bauxite for all purposes in 1949 decreased 2 percent to 2,667,043 long tons (dried equivalent). Total consumption figures include calcined bauxite shipped for export to American-owned abrasive plants in Canada for the manufacture of crude abrasives, which are returned to the United States for final manufacture and use. Bauxite consumption on an as-shipped basis totaled 2,691,171 tons, comprising 678,219 tons of crude ore, 1,882, 441 tons of dried bauxite, 123,511 tons of calcined bauxite, and 7,000 tons of activated bauxite. Of that consumed (dried equivalent basis) in 1949, 43 percent was from domestic sources and 57 percent from foreign. Approximately 79 percent of the domestic ore and 91 percent of the foreign were consumed by the alumina industry.

Bauxite consumed in the United States, 1948–49, by industries, in long tons

[Dried-bauxite equivalent]

Industry	1948			1949		
	Domestic	Foreign	Total	Domestic	Foreign	Total
Alumina [1]	965, 081	1, 314, 042	2, 279, 123	907, 645	1, 380, 728	2, 288, 373
Chemical	115, 264	42, 613	157, 877	92, 813	49, 046	141, 859
Abrasive and refractory	125, 030	122, 277	247, 307	126, 355	77, 086	203, 441
Other	26, 334	14, 499	40, 833	23, 918	9, 452	33, 370
Total	1, 231, 709	1, 493, 431	2, 725, 140	1, 150, 731	1, 516, 312	2, 667, 043

[1] Includes some bauxite used in making chemicals and other products.

Alumina.—Four alumina plants—located at Mobile, Ala.; Hurricane Creek, Ark.; Baton Rouge, La.; and East St. Louis, Ill.—produced alumina from 86 percent of the total bauxite consumed. Aluminum metal was eventually extracted from most of this alumina, but part was used by the chemical, abrasive, and refractory industries and some was processed into special products, such as activated[6] and tabular aluminas, for use in the oil-refining and ceramic industries.

Chemical.—The use of bauxite for the production of aluminum salts dropped about one-tenth from 1948. In addition to bauxite, however, aluminum salts producers reported consuming 11,161 short tons of aluminum trihydrate, 4,458 tons of secondary aluminum, 79,164 tons of clay, and a small quantity of bichromate residues and other materials. Consumption of bauxite for the production of nonmetallurgical alumina is included with the figures for alumina in the preceding paragraph and table.

[5] McIntosh, F. K., Investigation of Hamilton County Bauxite District, Tennessee: Bureau of Mines Rept. of Investigations 4550, 1949, 31 pp.

[6] Williams, A. E., Activated Alumina: Canadian Chem. and Process Ind., vol. 33, No. 1, January 1949, pp. 41–43.

Aluminum salts and alumina produced and shipped in the United States, 1948–49

	1948				1949			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Shippers	Short tons	Value		Shippers	Short tons	Value
Aluminum salts:								
Alum:								
Ammonia	5,768	4	5,931	$417,992	9,530	3	8,826	$667,409
Potash	2,744	3	3,334	250,436		2		
Aluminum chloride:								
Liquid	9,553	5	9,439	425,234	12,576	5	12,439	793,144
Crystal	17,403	1	17,528	2,923,057	18,104	1	14,997	2,657,208
Anhydrous		5				6		
Aluminum sulfate:								
Commercial:								
General	648,480	14	646,022	15,521,015	579,547	13	576,907	16,258,859
Municipal	14,829	8	14,891	318,055	14,151	6	14,141	292,050
Iron-free	25,193	6	24,404	1,081,452	23,949	6	23,859	1,065,664
Sodium aluminum sulfate	26,154	2	25,972	2,210,050	29,763	2	28,253	2,473,000
Sodium aluminate		10				10		
Total aluminum salts	750,124	[1] 37	747,521	23,147,291	687,620	[1] 35	679,422	24,207,334
Alumina [2]	82,512	7	60,080	5,605,013	71,278	6	54,149	4,629,063

[1] A company shipping more than 1 kind of salt is counted but once in arriving at total.
[2] Excludes alumina produced for use in making aluminum; includes activated, calcined, and crude alumina and light and heavy hydrate, converted to a calcined-alumina equivalent.

Losses in production and shipments of aluminum sulfate were the leading factors in causing an over-all decline in totals for aluminum salts, as liquid aluminum chloride and sodium aluminate gained while most other salts were virtually unchanged. Value of shipments increased slightly, despite fewer companies reporting shipments. Output of alumina for purposes other than aluminum production was lowered 14 percent in 1949, and shipments to other consumers dropped 10 percent.

Abrasive and Refractory.—Manufacturers of refractories in the United States and aluminous abrasive pigs in Canada and the United States consumed 18 percent less bauxite in 1949 than in 1948. Retarded use of foreign ore for abrasives constituted the major change during 1949.

Other.—Consumption of bauxite in other fields, notably the cement, oil-refining, steel, and ferro-alloy industries, declined 18 percent in 1949.

STOCKS

Total inventories of bauxite on hand December 31, 1949, were 3 percent above stocks at the close of 1948. Mines and processing plants lowered inventories from 568,075 long tons (dried equivalent) at the beginning of the year to 502,338 tons, but inventories at consumers' plants totaled 873,731 tons at the end of 1949 compared with 669,698 tons on December 31, 1948. The large Government-owned (War Assets Administration) stockpile of medium-grade bauxite in Arkansas, on which Reynolds Metals Co. as operators of the Hurricane Creek alumina plant held option to purchase if needed, remained unchanged at 2,785,527 tons throughout 1949. All stock figures mentioned in this chapter exclude bauxite held by the Bureau of Federal Supply for the National Stockpile.

Stocks of bauxite on hand December 31, 1945–49, in long tons

Year	Producers, crude	Processors		Consumers		Government, crude	Total	
		Crude	Processed [1]	Crude	Processed [1]		Crude and processed	Dried bauxite equivalent
1945	346,463	119,788	5,277	126,643	296,486	3,244,707	4,139,364	3,584,132
1946	350,565	196,599	9,853	62,442	181,708	[2] 3,277,090	[2] 4,078,257	[2] 3,516,901
1947	378,068	182,899	11,497	35,983	399,224	[2] 3,277,090	[2] 4,284,761	[2] 3,724,759
1948	495,297	159,304	7,441	57,191	590,124	[2] 3,277,090	[2] 4,586,447	[2] 4,023,300
1949	433,880	143,797	8,876	45,359	807,508	[2] 3,277,090	[2] 4,716,510	[2] 4,161,596

[1] Dried, calcined, activated, and sintered.
[2] Excludes stocks in the National Stockpile.

PRICES

The average selling price in 1949, f. o. b. mines and processing plants, was $4.98 per long ton for crude (undried) bauxite, $7.58 for crushed dried bauxite, $16.31 for calcined bauxite, and $61.19 for activated bauxite. In 1948, corresponding prices were $5.08 per ton for crude, $7.50 for dried, $14.90 for calcined, and $57.93 for activated. The weighted average price for all grades of domestic ore as shipped to consumers was $6.68 per ton in 1949 ($6.69 in 1948). Nominal market quotations as published by E&MJ Metal and Mineral Markets were unchanged during 1949 at the following prices: Domestic ore, chemical, crushed and dried, 55 to 58 percent Al_2O_3, 1.5 to 2.5 percent Fe_2O_3, $8 to $8.50, f. o. b. Alabama and Arkansas mines; other grades, 56 to 59 percent Al_2O_3, 5 to 8 percent SiO_2, $8 to $8.50, f. o. b. Arkansas mines; pulverized and dried, 56 to 59 percent Al_2O_3, 8 to 12 percent SiO_2, $14 to $16, f o. b. Arkansas mines; abrasive grade, crushed and calcined, 80 to 84 percent Al_2O_3, $17, f. o. b. Arkansas mines; crude (not dried) 50 to 52 percent, $4 to $5, f. o. b. Arkansas mines. Quotations on foreign bauxite have not been published in domestic trade journals since February 1941.

FOREIGN TRADE [7]

Imports of bauxite gained 8 percent in 1949, the fifth successive year of increase, and established a new high record. Of the total receipts, 2,013,187 long tons were from Surinam, 575,137 tons from Indonesia, 99,821 tons from British Guiana, and 19 tons from Canada. By customs districts, receipts were as follows: 1,818,903 tons at Mobile, 807,880 at New Orleans, 24,281 at New York, 17,865 at Philadelphia, 8,630 at Massachusetts, 2,845 at Georgia, 2,756 at Sabine, 2,534 at Maryland, 2,435 at Virginia, and 35 at Buffalo. The duty remained unchanged throughout 1949 at 50 cents a long ton for crude and dried bauxite and at 15 percent ad valorem for calcined bauxite.

Exports of bauxite and bauxite concentrates were less than two-thirds of the 1948 total, as 1949 marked the sixth year of uninterrupted decrease. Bauxite and other aluminum ores comprised 34,235 tons of the 1949 shipments, and only 667 tons were classified as bauxite

[7] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

concentrates (including alumina). Virtually all the bauxite exported went to Canada to be used in the production of crude abrasives, which are returned to the United States for final manufacture and consumption. Canada also received 264 tons of the bauxite concentrates, while Iran received 180 tons and 7 other countries the remainder.

Bauxite and aluminum compounds imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Bauxite			Alumina		Aluminum compounds	
	As imported (long tons)	Dried bauxite equivalent[1] (long tons)	Value	Long tons	Value	Short tons	Value
1945	739,581	737,081	$5,273,122	179	$10,940	----	----
1946	852,005	851,148	5,965,124	4	2,607	2	$654
1947	1,821,580	1,842,176	11,869,631	----	----	80	2,348
1948	2,488,915	2,558,037	15,820,743	6	3,547	5,559	124,167
1949	2,688,164	2,730,472	16,353,298	157	19,192	1,472	46,736

[1] Calculated by Bureau of Mines.

Bauxite and aluminum compounds exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Bauxite (including bauxite concentrates), long tons			Aluminum sulfate		Other aluminum compounds	
	As exported	Dried bauxite equivalent[1]	Value	Short tons	Value	Short tons	Value
1945	126,077	156,129	$2,424,921	37,972	$993,869	4,106	$536,350
1946	97,788	127,840	1,599,259	37,957	962,938	4,055	637,997
1947	94,369	141,235	1,888,040	23,389	706,572	3,753	788,374
1948	54,113	86,284	1,202,036	14,342	467,622	3,539	599,210
1949	34,902	57,628	512,779	14,706	554,710	4,155	664,018

[1] Calculated by Bureau of Mines.

WORLD REVIEW

The world production of bauxite in 1949 was estimated slightly below that of 1948. A substantial production gain was achieved in Indonesia; however, output declined in each of the four leading countries. The United States, together with Surinam and British Guiana, mined 61 percent of the world total, compared with 66 percent in 1948.

Austria.[5]—Although bauxite is known to occur elsewhere in Austria, it is mined only at Unterlaussa. Production from this deposit, worked by the Germans during World War II, was resumed in 1948 and increased in 1949. Most of the ore from Unterlaussa is consumed by the abrasive and iron and steel industries.

British Guiana.—Output of bauxite in British Guiana declined approximately 6 percent in 1949, but the colony remained the world's

[5] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 1, January 1950, pp. 4–5.

second largest producer. Most of the exports were shipped from the Demerara Bauxite Co. to its affiliate, the Aluminum Co. of Canada.

World production of bauxite, by countries, 1943–49, in metric tons [1]

[Compiled by Pauline Roberts]

Country [1]	1943	1944	1945	1946	1947	1948	1949
Australia:							
New South Wales	734	2,025	1,700	1,438	2,401	2,917	(2)
Victoria	1,855	1,842	1,792	2,351	2,555	2,819	4,093
Austria	24	19,843	8,756	—	—	5,324	6,526
Brazil	[3] 93,000	[3] 19,000	[3] 23,000	[3] 17,000	[3] 17,000	[3] 17,000	20,246
British Guiana	1,919,060	928,178	678,482	[4] 1,137,991	[4] 1,318,190	1,903,230	1,785,860
France	916,350	665,630	308,127	449,125	680,123	788,400	757,560
French Indochina	—	360	—	—	—	—	—
Germany	12,276	(2)	(2)	(2)	(2)	(2)	(2)
Gold Coast	162,685	107,854	148,547	116,846	[4] 97,437	[4] 133,055	[3, 4] 134,000
Greece	25,000	10,000	—	1,315	22,420	40,183	48,852
Haiti	—	—	300	300	—	—	—
Hungary	1,001,370	758,299	35,402	101,140	340,260	[3] 500,000	[3] 600,000
India	24,548	12,330	14,116	10,108	12,862	20,995	(2)
Indonesia	[5] 649,760	[5] 275,017	(2)	—	(2)	437,822	678,138
Italy	291,862	41,120	25,093	65,447	171,083	153,147	104,852
Japan	—	2,000	—	—	—	—	—
Malaya	[5] 168,336	[5] 72,343	—	—	—	—	—
Mozambique	3,272	6,177	4,369	1,622	2,784	2,960	(2)
Palau Island [6]	104,223	1,000	—	—	—	—	—
Rumania	12,633	(2)	(2)	663	[3] 600	(2)	(2)
Spain	23,947	2,921	5,119	4,926	5,822	6,805	10,293
Surinam	1,655,147	625,804	[4] 683,990	[4] 857,843	[4] 1,809,837	2,149,906	2,126,654
U. S. S. R. (estimate)	313,000	355,000	400,000	425,000	475,000	500,000	(2)
United Kingdom:							
Northern Ireland	107,924	44,502	36,981	—	—	—	(2)
United States (dried equivalent of crude ore)	6,332,921	2,869,045	996,754	1,121,774	1,221,348	1,480,535	1,167,230
Yugoslavia	(2)	(2)	(2)	(2)	[3] 60,000	[3] 190,000	(2)
Total [1]	13,970,000	6,992,000	3,482,000	4,440,000	6,250,000	8,336,600	8,264,000

[1] Bauxite is also produced in French West Africa, but production data are not available and no estimate is included in total.
[2] Data not available; estimate by junior author of chapter included in total.
[3] Estimate.
[4] Exports.
[5] Imports into Japan, Formosa, and Korea in fiscal year ended Mar. 31 of year following that stated; preliminary figures.
[6] Imports into Japan and Formosa in fiscal year ended Mar. 31 of year following that stated; preliminary figures.

France.—Reflecting in part the decrease in aluminum output in France during 1949, bauxite production was approximately 4 percent below the 1948 total. According to revised estimates, reserves of French ore were placed at 15 million tons of high-grade bauxite and 60 million tons classified as siliceous bauxite. Most of the ore mined has been converted to alumina, although suitable ore has been found for nearly all of the bauxite-consuming industries.

Hungary.—Increased mining of bauxite in Hungary during 1949 foreshadowed the nation's return to a position as one of the leading suppliers of aluminum ore. Markets in other central European countries and Russia, as well as the return of demand from Germany, formerly the destination of most Hungarian bauxite, indicated permanence in the growing industry. In accordance with plans for a larger aluminum industry, a greater proportion of bauxite was processed within Hungary than heretofore, but exports still exceeded domestic consumption in 1949.

Indonesia.—Output of bauxite on Bintan Island in Indonesia during 1949 gained 55 percent and reached a new record. United States was

the principal recipient of the ore exported, and most of the remainder was shipped to Japan.

Italy.—Since the loss of Istria to Yugoslavia, Italy's domestic bauxite mining has been largely in the Foggia and Bari areas. About 90 percent of the 1949 production, which was considerably below 1948, was mined from Montecatini holdings. A trade agreement with Yugoslavia guaranteed supplies from Istria and provided the major portion of Italy's approximately 85,000 metric tons of bauxite imports in 1949.

Jamaica.—Much interest has developed in the low-silica, high-iron bauxite deposits of Jamaica, both as a result of diminishing reserves in United States and because of the strategic importance of aluminum ore nearer the United States than the Guianas. Deposits under consideration were reported having little overburden and located not far from the seacoast. At the close of 1949, Reynolds Metals Co. and two subsidiaries were completing a contract with the Economic Cooperation Administration for Marshall Plan and ECA counterpart funds to help finance the purchase and installation of mining, milling, and transportation equipment. Kaiser Aluminum & Chemical Corp. investigated the utilization of deposits on which it acquired options, and the Aluminum Co. of Canada was also known to have deposits on the island.

Spain.[9]—Although the Spanish aluminum industry has relied mainly upon foreign ore in past years, increased mining during 1949 reflected plans for utilizing domestic bauxite in new plants. Ore reserves occur in the Provinces of Barcelona, Tarragona, Lérida, and Teruel.

Surinam.—The Moengo and Paranam mines of the Surinaamsche Bauxiet Maatschappij produced over 80 percent and the N. V. Billiton Maatschappij the remainder of the total bauxite output of Surinam in 1949, which was slightly below the foregoing year. Delays were attributed to heavy rains and a strike for increased wages at the Billiton mine. The Rickanau deposit, reported to compare favorably with Moengo in extent and grade of ore, was connected to the Moengo mill by completion of a 9-mile railroad during 1949. A revised tax system[10] affecting bauxite mining was instituted by the Surinam Government.

[9] Bureau of Mines, Mineral Trade Notes: Vol. 27, No. 5, November 1948, pp. 7–12.
[10] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 1, July 1949, pp. 3–5.

Bismuth

By Jack W. Clark

GENERAL SUMMARY

GOVERNMENT-financed purchases of refined metal, both for the National Stockpile and for United Kingdom and continental consumers under the European Recovery Program, served to stabilize the market for bismuth in 1949. Sustained high output of primary lead, from which most domestic bismuth is won as a byproduct, resulted in a total production of bismuth metal about equal to that in 1948. Imports, mostly from Peru, were the largest on record. Exports declined 46 percent below 1948. Producers' stocks rose 25 percent. The fission of bismuth with high-energy neutrons was a matter of considerable interest in nuclear research.

DOMESTIC PRODUCTION

Virtually all domestic production of bismuth is derived as a by-product from the smelting of lead ores and the refining of imported bismuth bars containing lead as a major impurity. The total quantity of metal recovered in 1949 rose slightly above 1948, reflecting a continued high rate of activity at primary lead smelters.

Companies reporting output of refined bismuth metal in 1949 were the American Smelting & Refining Co., Omaha, Nebr., and Perth Amboy, N. J.; Anaconda Copper Mining, Co., Anaconda, Mont.; and U. S. S. Lead Refinery, Inc. (subsidiary of United States Smelting, Refining & Mining Co.), East Chicago, Ind. Cerro de Pasco Copper Corp. is the principal domestic producer of bismuth alloys at its Brooklyn, N. Y., works; bismuth metal used is obtained from the company lead smelter at La Oroya, Peru.

CONSUMPTION AND USES

Demand for bismuth, particularly in the form of refined metal, was firm in 1949. Producers' domestic sales were 7 percent above those in 1948. Purchases for the National Stockpile are believed to have been substantial. Bismuth compounds were reported in plentiful supply in 1949.

Bismuth metal is consumed mainly in the compounding of low-fusibility, bismuth-rich nonferrous alloys and of pharmaceuticals used principally for the treatment of stomach disorders. The fusible alloys of greatest utility contain 40 to 60 percent bismuth, with varying proportions of other metals, such as tin,[1] lead, cadmium, antimony,

[1] Tin Research Institute (Greenford, Middlesex, United Kingdom), Fusible Alloys Containing Tin: September 1949, 24 pp.

indium, and zinc. Alloys of this type have become strategic because of their time-saving applications in the aircraft, machine-tool, and automotive industries. A few important uses are in the bending of thin-walled tubing, spotting and securing of dies and punches, pattern-making, and electroforming.

Bismuth is employed to a small extent in the preparation of phosphors,[2] selenium rectifiers, special solders, and safety devices. The newly developed Standfast (British) metal machine for continuous vat dyeing of textiles uses a bath of molten bismuth alloy as a color-fixation medium.

Percentage distribution of bismuth consumed in the United States, 1945–49, according to major use group [1]

Use group	1945	1946	1947	1948	1949
Pharmaceuticals	51	63	52	49	31
Alloys [2]	49	37	48	51	69

[1] Computed from figures compiled by Civilian Production Administration and U. S. Department of Commerce, 1945–46, and by Bureau of Mines, 1947–49.
[2] Principally fabricating alloys but includes ammunition solders, fuse alloys, aluminum alloys, and other minor compositions.

STOCKS

Domestic producers' inventories of refined bismuth metal at the end of 1949 increased 25 percent above the same 1948 period. High-grade metal was actively sought during the year for the National Stockpile.

PRICES

Refined bismuth metal was quoted by E&MJ Metal and Mineral Markets at $2 per pound, ton lots, throughout 1949. This price has remained unchanged since it was established in February 1947. The Metal Bulletin (London) quotation for high-purity metal, per pound, 5 cwt. minimum, held steadily at 10s. 9d. for the first half of 1949, subsequent fluctuations being recorded as follows: June 14, 10s. 6d.; September 20, 10s.; October 4, 12s. 3d.–14s. 6d. Bismuth ore, per pound of contained metal, c. i. f., was quoted late in December 1949 at 9s. 6d., 65 percent minimum Bi, scaling downward to 1s. 3d. for ore assaying below 20 percent.

In December 1949, Cerro de Pasco Copper Co., largest United States producer of bismuth alloys, quoted the following prices per pound, in 100-pound lots or more, f. o. b., for various of its trade-marked alloys: Cerrobase, $1.17; Cerrobend, $1.36; Cerrocast, $1.37; Cerromatrix, $1.19; Cerrosafe, $1.20; and Cerrotru, $1.53. Cerrolow 105 and Cerrolow 117, each containing an appreciable indium content, were quoted, respectively, at $7.92 and $7.61 per pound, in lots of 1 pound or larger.

[2] Kröger, F. A., Overbeek, J. T. G., Goorissen, J., and van den Boomgaard, J., Bismuth as Activator in Fluorescent Solids: Jour. Electrochem. Soc., vol. 96, No. 3, September 1949, pp. 132–141.

FOREIGN TRADE[3]

Imports.—Receipts of refined metal in 1949 showed an abrupt rise of 81 percent above 1948 and were the highest on record. The approximate percentage distribution of receipts by countries of origin was: Peru 78, Canada 10, Yugoslavia 8, Japan 2, and Korea 2 percent. Base-bullion (bismuth bars containing lead and other impurities) shipments to United States smelters declined about 98 percent below the abnormally high year 1948.

Exports.—Outgoing shipments of bismuth metal and alloys in 1949 slumped 46 percent below a year earlier. The United Kingdom was again the principal recipient, taking 138,765 pounds; France received 41,926 pounds. The metal shipped to France is believed to have been purchased with funds allocated for such use by the Economic Cooperation Administration in the latter part of 1948 under the European Recovery Program. Since 1937, the first year of record, United States exports of bismuth metal have ranged between an estimated peak of 900,000 pounds in 1937 to a low of 10,161 pounds in 1944.

Bismuth metal and alloys imported into and exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Imports of refined metallic bismuth		Exports of metal and alloys	
	Pounds	Value	Pounds	Value
1945	333,231	$316,135	115,543	$149,031
1946	422,336	464,922	153,058	173,463
1947	310,561	480,808	240,833	452,147
1948	299,824	464,733	352,027	711,354
1949	541,852	833,940	190,882	356,576

TECHNOLOGY

Bismuth is fissionable when bombarded with high energy nuclear particles;[4] the relative yields of the fission products were noted.

The constitutions of bismuth-antimony[5] and bismuth-indium[6] alloys and the electrical properties of bismuth oxide[7] were studied. The problem of copper embrittlement by traces of bismuth was the

[3] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[4] Perlman, I., Goeckermann, R. H., Templeton, D. H., and Howland, J. J., Fission of Bismuth, Lead. Thallium, Platinum and Tantalum with High-Energy Particles: Phys. Rev., 2d ser., vol. 72, No. 4, Aug. 15, 1947, p. 352.

Goeckermann, R. H., and Perlman, I., Characteristics of Bismuth Fission with High-Energy Particles: Phys. Rev., 2d ser., vol. 73, No. 9, May 1, 1948, pp. 1127–1128.

Kelly, E. L., and Wiegand, Clyde, Fission of Elements from Pt to Bi by High-Energy Neutrons: Phys. Rev., 2d ser., vol. 73, No. 10, May 15, 1948, pp. 1135–1139.

Goeckermann, R. H., and Perlman, I., High-Energy-Induced Fission of Bismuth and Lead: Phys. Rev., 2d ser., vol. 76, No. 5, Sept. 1, 1949, pp. 628–637.

Jungerman, J., and Wright, S. C., Kinetic Energy Release in Fission of U238, U235, Th232, and Bi209 by High-Energy Neutrons: Phys. Rev., 2d ser., vol. 76, No. 8, Oct. 15, 1949, pp. 1112–1116.

[5] Masing, Georg, Rahlfs, Paul, and Schaariwächter, Werner [The Constitution of Bismuth-Antimony Alloys]: Ztschr. Metallkunde, vol. 40, No. 9, September 1949, pp. 333–334.

[6] Peretti, E. A., and Carapella, S. C., Indium-Bismuth Phase Diagram: Trans. Am. Soc. Met., vol. 41, 1949, pp. 947–958.

[7] Mansfield, R., The Electrical Properties of Bismuth Oxide: Proc. Phys. Soc. (London), vol. 62 B, part 8, Aug. 1, 1949, pp. 476–483.

subject of several papers.[8] The extractive metallurgy of bismuth was studied [9] and equipment and operation of a small bismuth refining plant described.[10]

WORLD REVIEW

Australia.—The prices of bismuth ores and concentrates in 1949 were fixed by the Commonwealth Prices Commission as follows: 13s. 4d. per pound of metal contained in material assaying 70 percent Bi or better, the price being scaled downward 1d. per pound for each unit below 70 percent until a minimum of 20 percent bismuth is reached.[11] The possibility of commercial recovery of bismuth and copper, along with gold, at Tennant Creek, Northern Territory, was discussed.[12] Bismuth oxides and carbonates are widespread, invariably accompanying high gold values. Several thousand tons of ore averaging 0.4 percent Bi were reported blocked out.

Canada.—Consolidated Mining & Smelting Co. of Canada, Ltd., principal Canadian producer of bismuth metal, reported its total output for the periods 1894–1939 and 1940–49, inclusive, at 677 and 1,029 short tons, respectively. Domestic consumption of metal was 71 tons in 1947 and 44 in 1948; for the same years, producers' exports totaled 61 and 79 tons.

Korea.—The mill feed at the tungsten concentrator of the Sang Dong mine near Seoul contains about 0.2 percent of bismuthinite, which is recovered as a byproduct.

Uganda.—1949 output of bismuth ore from the Nyakashunzu mine was 6.88 tons; several more tons were obtained from another bismuth area west of Nyakashunzu. At the year-end production of bismuth ore was reported on the verge of rapid expansion.[13]

United Kingdom.—Activities of Mining & Chemical Products, Ltd., one of the world's largest producers of bismuth metals and alloys, were described.[14]

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[8] Hallowes, A. P. C., The Embrittlement of Tough Pitch Copper by Bismuth: Jour. Inst. Metals, vol. 75, part 10, June 1949, pp. 839–854 (Paper 1184).

Hallowes, A. P. C., The Working Behavior of Phosphorus-Deoxidized Coppers Containing Bismuth: Jour. Inst. Metals, vol. 75, part 1, September 1948, pp. 1–18 (Paper 1139).

Thews, Edward R. [New Information on the Removal of Bismuth from Copper by the Melting Technique]: Metall, Nos. 21–22, November 1948, pp. 364–365.

[9] Evers, Dietrich [Removal of Bismuth by the Kroll-Betterton Methods]: Ztschr. Erzbergbau und Metallhutterw., vol. 2, No. 5, May 1949, pp. 129–133.

[10] Metal Industry (London), Refining Bismuth: Vol. 75, No. 4, July 22, 1949, p. 67.

[11] Queensland Government Mining Journal, vol. 50, No. 577, November 1949, p. 648.

[12] Rankin, R. Ian, Tennant Creek Field: Chem. Eng. and Min. Review (Australia), vol. 42, No. 3, Dec. 10, 1949, p. 86.

[13] The Mining Journal (London): Vol. 234, No. 5979, March 24, 1950, p. 190.

[14] The Metal Bulletin (London), No. 3387, Apr. 29, 1949, p. 12.

World production of bismuth, 1942–49, by countries, in kilograms [1]

[Compiled by Berenice B. Mitchell]

Country [1]	1942	1943	1944	1945	1946	1947	1948	1949
Argentina: Metal	13,101	18,000	14,000	20,120	22,000	22,000	(2)	(2)
In ore [3]	17,000	25,000	24,500	31,000	12,000	20,000	(2)	(2)
Australia (in ore)[4]	762	5,741	3,556	3,251	1,270	3,201	4,000	(2)
Belgian Congo (in ore)	--------	--------	--------	--------	--------	815	456	(2)
Bolivia (in ore and bullion exported)[5]	8,896	12,419	605	15,337	27,867	88,964	35,142	8,222
Canada (metal) [6]	157,648	184,882	56,188	86,098	109,090	128,988	108,971	93,893
China (in ore)[3]	11,000	(2)	(2)	--------	1,380	(2)	(2)	(2)
France (in ore)	10,000	4,000	3,000	--------	--------	55,000	[3] 30,000	[3] 30,000
Germany: In bismuth ore	17,500	(2)	(2)	(2)	(2)	(2)	(2)	(2)
In other ores	14,700	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Japan (metal)	[7] 71,000	[7] 66,000	[7] 54,000	(2)	15,914	22,862	23,327	[3] 25,000
Korea, South	(2)	(2)	(2)	(2)	--------	--------	104,000	173,420
Mexico (in impure bars)	128,041	175,055	165,379	161,368	76,000	256,000	154,000	249,000
Peru: Metal	373,942	482,920	416,159	307,446	221,778	233,794	205,861	213,137
In lead-bismuth alloy	16,913	--------	--------	1,500	89,665	3,043	47,225	2,398
Spain (metal)	15,880	15,198	4,910	10,071	13,756	21,172	24,269	(2)
Sweden	--------	--------	--------	--------	12,441	10,998	--------	(2)
Union of South Africa (in ore)	167	1,890	818	610	711	--------	437	5,045
United States	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
World production (estimate)	1,700,000	1,400,000	1,200,000	1,100,000	900,000	1,200,000	1,400,000	1,500,000

[1] Bismuth is believed to be produced also in Brazil, Burma, Norway, Rumania, Uganda, U. S. S. R., United Kingdom, and Yugoslavia. Production figures are not available for these countries, but estimates by author are included in total.
[2] Data not available. Estimate by author included in total.
[3] Estimate.
[4] Partly estimated. Excludes content of some bismuth-tungsten concentrates.
[5] Excludes bismuth content of tin concentrates exported.
[6] Refined metal plus bismuth content of bullion exported.
[7] Incomplete data for year ended March 31 of year following that stated.
[8] Production included in total; Bureau of Mines not at liberty to publish separately.

Cadmium

By Richard H. Mote

GENERAL SUMMARY

CADMIUM experienced an economic position unique among most metals during 1949. Consumer demand remained strong despite the general industrial recession in midyear, and the market price for commercial sticks continued unchanged at $2. A record peacetime output of primary metal, 6 percent greater than in 1948, and a sixteen-fold increase in metal imports expanded the total domestic supply sufficiently to meet requirements and yet maintain the proper balance between supply and demand necessary to prevent fluctuations in market quotations. Sales of metallic cadmium advanced 3 percent over 1948 and nearly equaled production. Industry stocks, sharply reduced in 1948, were replenished in 1949, and the Federal Government continued to purchase metal for the National Stockpile. As a result, the apparent industrial consumption declined 14 percent from the 1948 level.

Salient statistics of the cadmium industry in the United States, 1940–44 (average) and 1945–49, in pounds of contained cadmium

	1940-44 (average)	1945	1946	1947	1948	1949
Production (primary)	7,642,978	8,383,629	6,471,187	8,508,146	7,775,657	8,374,561
Imports (metal)	68,737	28,724	17,415	20,292	9,809	157,204
Exports (metal)	[1] 318,639	102,199	140,385	303,401	955,701	566,135
Consumption, apparent	[2] 7,569,800	8,642,799	6,983,610	7,726,753	[3] 7,797,105	7,676,800

[1] 1942–44 average.
[2] Actual consumption.
[3] Revised figure.

DOMESTIC PRODUCTION

As cadmium minerals—the most common of which is greenockite (CdS, 77.8 percent cadmium)—are too rare in occurrence to support profitable mining, no ore is mined or concentrated for the recovery of cadmium alone. The metal is recovered entirely in the mining, milling, and smelting of sulfide ores containing zinc mineralization and is obtained chiefly from the zinc sulfide sphalerite (ZnS), on which greenockite occurs as a yellow stain or coating. Although some zinc concentrates have been reported to contain as much as 1 percent cadmium, the content seldom exceeds 0.5 percent. Zinc concentrates from the tri-State region average 0.35 percent cadmium, and concentrates from mines in the Rocky Mountain region and far West rarely carry more than 0.2 percent cadminm.

The entire domestic supply of primary cadmium is recovered concurrently with the treatment of ores of other metals as a byproduct from the flue dusts of zinc-blende roasting furnaces and lead blast furnaces, from zinc dust collected in the early stages of distillation in zinc retorts, and from the high-cadmium precipitate obtained in purifying zinc electrolyte at electrolytic zinc plants. A small quantity of secondary metal is recovered from old bearings and other alloys but constitutes no great portion of the total supply. As most reduction plants participating in the recovery of cadmium treat both domestic and foreign cadmium-bearing materials without determining the cadmium content of either, the geographic origin of the metal produced from domestic plants is a matter of conjecture. Thus the data presented as domestic cadmium production in this chapter are not comparable to those given in other chapters of this volume for metals like copper, lead, and zinc.

Cadmium produced and shipped in the United States, 1940–44 (average) and 1945–49, in pounds of contained cadmium

	1940–44 (average)	1945	1946	1947	1948	1949
Production:						
Primary:						
Metallic cadmium	7,453,048	7,932,579	6,200,398	8,007,287	7,582,961	8,023,616
Cadmium compounds [1]	189,936	451,050	270,789	500,859	192,696	350,945
Total primary production	7,642,984	8,383,629	6,471,187	8,508,146	7,775,657	8,374,561
Secondary (metal and compounds) [1] [2]	238,604	72,473	355,104	104,764	121,159	173,104
Shipments by producers:						
Primary:						
Metallic cadmium	7,524,582	7,938,658	6,180,265	7,852,907	7,639,113	7,867,486
Cadmium compounds [1]	194,563	451,050	270,789	500,859	192,696	350,945
Total primary shipments	7,719,145	8,389,708	6,451,054	8,353,766	7,831,809	8,218,431
Secondary (metal and compounds) [1] [2]	240,671	67,513	360,924	134,793	121,159	173,104
Value of primary shipments:						
Metallic cadmium	$5,754,248	$6,106,992	$6,094,572	$12,358,526	$12,679,571	$14,813,382
Cadmium compounds [3]	147,214	347,308	267,033	788,352	319,875	659,777
Total value	5,901,462	6,454,300	6,361,605	13,146,878	12,999,446	15,473,159

[1] Excludes compounds made from metal.
[2] Bureau of Mines not at liberty to publish figures separately for secondary cadmium compounds.
[3] Value of metal contained in compounds made directly from flue dust or other cadmium raw materials (except metal).

The domestic output of primary metallic cadmium, the production of cadmium contained in primary compounds, and the recovery of cadmium in secondary metal and compounds increased 6, 82, and 43 percent, respectively, in 1949.

A list of plants producing cadmium metal in the United States in 1949 follows:

Primary metallic cadmium

Colorado: Denver—American Smelting & Refining Co.
Idaho:
  Bradley—Bunker Hill & Sullivan Mining & Concentrating Co.
  Kellogg—Sullivan Mining Co.

Illinois: Fairmont City—American Zinc Co. of Illinois.
Missouri: Herculaneum—St. Joseph Lead Co.
Montana: Great Falls—Anaconda Copper Mining Co.
Oklahoma:
Bartlesville—National Zinc Co., Inc.
Henryetta—Eagle-Picher Mining & Smelting Co.
Pennsylvania:
Donora—American Steel & Wire Co.
Josephtown—St. Joseph Lead Co.
Palmerton—New Jersey Zinc Co.
Texas:
Corpus Christi—American Smelting & Refining Co.
Dumas—American Zinc Co. of Illinois.

Secondary metallic cadmium

Arkansas: Jonesboro—Arkansas Metals Co.
New York: Whitestone—Neo-Smelting & Refining, Inc.
Rhode Island: West Warwick—Rare Metals, Inc.

The cadmium content of the cadmium oxide produced advanced 71 percent but the content of the sulfide output dropped 9 percent. Data for the production of other cadmium compounds are not available for 1949.

Cadmium oxide and cadmium sulfide produced in the United States, 1945–49, in pounds

Year	Oxide		Sulfide [1]		Year	Oxide		Sulfide [1]	
	Gross weight	Cd content	Gross weight	Cd content		Gross weight	Cd content	Gross weight	Cd content
1945	439,415	383,553	1,731,516	637,667	1948	334,859	291,847	3,137,035	1,096,770
1946	364,285	317,767	3,637,177	1,285,680	1949	570,993	497,876	2,631,888	999,386
1947	449,847	392,556	3,501,508	1,308,285					

[1] Includes cadmium lithopone and cadmium sulfoselenide.

CONSUMPTION AND USES

The apparent consumption of primary cadmium in all forms totaled 7,676,800 pounds in 1949, as computed by adding production and net imports and adjusting for producers', distributors', and compound manufacturers' stock changes. This quantity was 2 percent less than the apparent consumption of 7,797,105 pounds in 1948. In both 1948 and 1949 cadmium metal was purchased by the Federal Government for the National Stockpile. Allowing for these Government withdrawals, the apparent industrial consumption of cadmium in 1949 was 14 percent under 1948 and over 30 percent less than the peak quantity used in 1945.

By far the largest single use of cadmium is for electroplating iron, steel, and, to a much smaller extent, copper alloys. The metal is desired for this use because (1) a thin coating is adequate to provide the necessary protection against corrosion; (2) cadmium has a high

Properties of cadmium compounds

Name and formula of compound	Molecular weight	Appearance	Specific gravity	Melting point, °C.	Boiling point, °C.	Soluble in—	Manufacture	Use
Cadmium acetate ($Cd(C_2H_3O_2)_2 \cdot 3H_2O$).	284.55	Colorless, monoclinic crystals.	2.01	256 (becomes anhydrous at 130).		Water and alcohol	Dissolve cadmium metal, CdO, or $Cd(OH)_2$ in acetic acid; evaporate solution to incipient crystallization.	To produce iridescent effects on porcelain and pottery ware; chemical testing for sulfides, selenides, and tellurides.
Cadmium bromide ($CdBr_2$).	272.24	Yellow, crystalline powder.	5.20	567	963	Water, alcohol, and HCl; slightly soluble in acetone and ether.	Dissolve cadmium metal in bromine water acidified with hydrogen bromide to prevent formation of basic salts; or dissolve $CdCO_3$ in aqueous hydrogen bromide and evaporate solution to dryness.	Photography, lithography, and process engraving.
Cadmium carbonate ($CdCO_3$).	172.42	White, crystalline powder.	4.26	Decomposes below 500.		Acids, potassium cyanide, and ammonium salts.	Add an alkali carbonate to a solution of a cadmium salt.	Starting compound for other cadmium salts.
Cadmium chloride ($CdCl_2$).	183.32	Colorless, hexagonal crystals.	4.05	568	960	Water, methanol, and ethyl alcohol.	Dissolve cadmium metal in an aqueous solution of HCl and evaporate in a stream of HCl gas; or dissolve CdO or $CdCO_3$ in HCl.	Reagent in photography; analysis of sulfides; testing for pyridin bases; ingredient in cadmium plating electrolytes; mordant in dyeing and printing calicoes.
Cadmium hydroxide ($Cd(OH)_2$).	146.43	White powder	4.79	Decomposes at 300.		Dilute acids and in ammonia salts. Readily absorbs CO_2 to form $CdCO_3$.	Add ammonium hydroxide to solution of a cadmium salt, producing gelatinous precipitate with the formation of the complex ammonia ion. To obtain purest material, precipitate from a nitrate solution, for it absorbs the nitrate ion less strongly than either the chloride or sulfate ion.	Manufacture of cadmium salts.

Properties of cadmium compounds—Continued

Name and formula of compound	Molecular weight	Appearance	Specific gravity	Melting point, °C.	Boiling point, °C.	Soluble in—	Manufacture	
Cadmium iodide (CdI_2)	366.25	Brownish, lustrous, hexagonal scales.	5.67 (α) 5.30 (β)	388 -	713 -	Water, acids, ether, alcohol, ammonium salts.	Heat cadmium metal with iodine, or treat a cadmium compound with a solution of hydrogen iodide.	Photography, lithography, and process engraving.
Cadmium oxide (CdO_2)	128.41	Light-brown to yellowish brown to dark-brown cubic crystals or amorphous powder, depending upon method of preparation.	8.15 (cubic form). 6.95 amorphous).	Above 1,426 Decomposes at 900.	Decomposes at 900–1,000.	Acids and ammonia salts.	(1) Distill pure cadmium metal in graphite retort, and permit vapor to react with air. (2) Heat $CdCO_3$ or $Cd(NO_3)_2 \cdot 4H_2O$ temperature of thermal decomposition to form CdO_2.	Cadmium plating baths; manufacture of paint pigments; coating for luminescent powders, such as cadmium sulfide and zinc sulfide; active ingredient in negative plates of nickel-cadmium batteries.
Cadmium nitrate ($Cd(NO_3)_2 \cdot 4H_2O$).	308.49	White, hygroscopic crystals.	2.46	594	132	Water, alcohol, and liquid ammonia.	Dissolve the metal, CdO_2, or $CdCO_3$ in HNO_3, and evaporating to incipient crystallization.	Imparts a reddish yellow cadmium luster to glass and porcelain ware.
Cadmium sulfate ($3CdSO_4 \cdot 8H_2O$).	769.54	Colorless, monoclinic, efflorescent crystals	3.09	-	-	Water	Dissolve metal in H_2SO_4, CdO_2 or $CdCO_3$.	Reagent to determine H_2S and detect fumaric acid; as an electrolyte in standard cadmium electric cells; in medicine for diseases of the eye, for corneal opacities, conjunctivitis leucoma.
Cadmium sulfide (cadmium yellow) (CdS).	144.47	Amorphous, yellow, orange, or brown powder. Dimorphous crystals in lemon-yellow or vermilion.	3.91–4.15 (α). 4.48–4.51 (β).	-	-	Acids	(1) Heat CdO_2 with sulfur. (2) Pass H_2S through acid solution of cadmium salt (better-quality producer). (3) Dissolve CdO_2 in H_2SO_4, CdS precipitated from this solution by H_2S.	Pigment in paints requiring high-quality yellow pigments: coloring vulcanized rubber, artists' colors, soaps, glass, textiles, paper, printing inks, ceramic glazes; ingredient of ultra-marine green and fluorescent pigments.

rate of deposition; (3) the metal has a high throwing power (the property of depositing uniformly on intricately shaped objects); (4) cadmium is capable of imparting an enduring metallic luster to the electroplated item; and (5) cadmium has high resistivity to atmospheric, alkali, and salt-water corrosion. A disadvantage of cadmium plating is its low resistance to acids. Items commonly electroplated with cadmium include nails, screws, rivets, bolts, nuts, washers, fasteners, and miscellaneous parts for a wide variety of products, including aircraft, ordnance, and automobiles.

Another large use of cadmium metal is in the manufacture of bearing metals. Cadmium-base bearing metals containing 98.3 to 98.5 percent cadmium and varying quantities of nickel, silver, or copper, depending upon the type of bearing desired, are used successfully in internal-combustion engines that operate at high speeds and temperatures.

Small quantities of cadmium metal are consumed for the manufacture of solders and other alloys.

Cadmium is consumed in the manufacture of a number of compounds having a wide variety of uses. The accompanying table lists the more important cadmium compounds, their physical properties, and uses.

STOCKS

Total domestic stocks of cadmium metal and compounds increased 51 percent in 1949. Details are given in the following table.

Cadmium stocks at end of year, 1948–49, in pounds of contained cadmium [1]

	1948 [2]			1949		
	Metallic cadmium	Cadmium compounds	Total cadmium	Metallic cadmium	Cadmium compounds	Total cadmium
Producers	351,564		351,564	509,019		509,019
Compound manufacturers	8,230	87,944	96,174	8,360	121,909	130,269
Distributors [3]	83,496	39,409	122,905	184,417	35,768	220,185
Total stocks [4]	443,290	127,353	570,643	701,796	157,677	859,473

[1] Excludes cadmium in National Stockpile.
[2] Figures partly revised.
[3] Comprises principally 8 largest dealers.
[4] Excludes consumers' stocks, which were about 1,000,000 pounds at the end of 1944 (latest date for which figures were compiled).

PRICES

The quoted New York price of $2 a pound for commercial sticks of cadmium, established November 15, 1948, remained unchanged throughout 1949. The price for patented shapes, quoted at $2.10 a pound since November 15, 1948, was adjusted upward to $2.15 a pound on April 1. The average price for domestic metal, as reported to the Bureau of Mines by primary producers, was $1.88 a pound in 1949, compared with $1.66 in 1948, $1.57 in 1947, 99 cents in 1946, 77 cents in 1945, and 75 cents in 1944.

The London market quoted 12s. 6d. ($2.42) per pound in January through mid-September, when quotations were suspended. Due to devaluation of the British pound on September 19, the price as announced the first week in October was 14s. 6d. ($1.97), at which level it remained the balance of the year.

FOREIGN TRADE[1]

In 1949 total imports for consumption of metallic cadmium and of cadmium contained in flue dust increased 6 percent in weight and 30 percent in value. The total value of exports fell off 34 percent owing to sharp declines in the quantity of exported metal and drosses, flue dust, residues, and scrap.

Imports.—Imports of cadmium-bearing flue dust, virtually all from Mexico, dropped slightly more than 2 percent from the 1948 rate. Imports of metallic cadmium, however, were over 16 times greater than the total imported in 1948 and the largest quantity recorded since 1939. Canada supplied over 43 percent of the metal imported in 1949, nearly 31 percent came from Belgium-Luxembourg, 20 percent from Japan, 5 percent from Australia, and 1 percent from Peru.

Cadmium metal and flue dust imported for consumption in the United States, 1947–49, by countries

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Pounds	Value	Pounds	Value	Pounds	Value
Metallic cadmium						
Australia					7,210	$7,919
Belgium-Luxembourg	2,000	$7,073			48,503	101,560
Canada	14,612	20,551	6,300	$14,491	68,140	139,392
Japan					31,640	50,742
Peru	3,658	4,508	3,509	7,018	1,711	3,422
Switzerland	2	150				
United Kingdom	20	63				
Total metallic cadmium	20,292	32,345	9,809	21,509	157,204	303,035
Flue dust (Cd content)						
Australia			621	303		
Brazil					2,906	2,801
Mexico	2,355,588	1,673,153	1,827,518	1,437,833	1,786,761	1,593,142
Total flue dust	2,355,588	1,673,153	1,828,139	1,438,136	1,789,667	1,595,943
Grand total	2,375,880	1,705,498	1,837,948	1,459,645	1,946,871	1,898,978

Exports.—Countries in the Organization for European Economic Cooperation continued to receive substantial quantities of metallic cadmium from the United States in 1949, despite a drop of 41 percent in the exports of this item from the 1948 level. Of the 566,135 pounds of cadmium metal exported, France received 45, Germany 16, United Kingdom 8, Netherlands 7, and Sweden 6 percent; the remaining 18 percent went to 15 other countries.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Cadmium exported from the United States, 1947–49, gross weight, by kinds

[U. S. Department of Commerce]

Kind	1947		1948		1949	
	Pounds	Value	Pounds	Value	Pounds	Value
Dross, flue dust, residues, and scrap	18,251	$21,838	92,847	$55,247	500	$125
Metal	303,401	746,804	955,701	1,872,467	566,135	1,264,307
Alloys			1,506	2,657	3,000	6,150
Total		768,642		1,930,371		1,270,582

Tariff.—Action taken at the Geneva Trade Conference of 1947 reduced, as of January 1, 1948, the import duty on cadmium metal from 7½ cents per pound as established in the Canadian Trade Agreement of 1939 to 3¾ cents per pound. Cadmium contained in flue dust remained duty free in 1949.

WORLD PRODUCTION

World production of cadmium in recent years, insofar as data are available, is shown in the accompanying table.

World production of cadmium, by countries, 1942–49, in kilograms

[Compiled by Berenice B. Mitchell]

Country	1942	1943	1944	1945	1946	1947	1948	1949
Australia (Tasmania)	166,184	181,689	271,610	245,955	231,913	212,354	293,638	[1] 157,488
Belgian Congo	27,344	23,094	21,544	18,213	16,571	26,040	18,000	[2] 27,000
Belgium	[3] 40,188	[3] 31,797	[3] 1,089	(3)	[4] 88,900	[4] 86,300	[4] 157,900	(3)
Canada	521,158	356,804	239,032	293,048	364,073	325,874	347,491	383,185
France	10,000	10,000	5,250	7,000	47,000	43,000	50,067	(3)
Germany	243,124	275,783	209,105	(3)	[5] 1,000	[5] 1,206	[5] 3,500	[5] 5,000
Italy	122,785	71,606	38,855	28,800	40,000	38,400	47,000	[1] 57,000
Japan	[6] 102,000	[6] 112,000	[6] 85,000	[7] 22,000	7,509	8,710	18,874	(3)
Mexico [8]	854,264	801,992	682,205	1,052,766	717,000	778,000	905,000	819,000
Norway	13,482	11,355	10,600	13,000	28,000	50,000	69,000	(3)
Peru	2,131	3,653	2,174	9,320	850	1,407	1,592	800
Poland	231,784	219,991	195,044	49,150	115,000	[9] 71,000	(3)	(3)
South-West Africa [10]							431,000	757,818
U. S. S. R.	[11] 50,000	(3)	(3)	(3)	(3)	(3)	(3)	(3)
United Kingdom	159,234	189,228	206,541	222,713	121,925	106,440	115,768	162,662
United States:								
Metallic cadmium	3,321,797	3,808,474	3,834,409	3,598,139	2,812,439	3,632,925	3,490,555	3,639,432
Cadmium compounds (Cd content)	21,600	32,100	148,045	204,592	122,827	227,185	87,495	159,185
Total	5,033,000	5,378,000	5,318,000	4,764,000	[illegible]	4,930,000	4,840,000	5,080,000

[1] January to September, inclusive.
[2] Exports.
[3] Data not available; estimate by author of chapter included in total.
[4] Incomplete data.
[5] Bizonal area.
[6] Preliminary data for fiscal year ended Mar. 31 of year following that stated.
[7] April to September, inclusive.
[8] Cadmium content of flue dust exported for treatment elsewhere; represents in part shipments from stocks on hand. To avoid duplication of figures, data are not included in the total.
[9] January to July, inclusive.
[10] Cadmium content of concentrates exported for treatment elsewhere. To avoid duplication of figures, data are not included in the total.
[11] Estimated average for 1936–38.

Carbon Black

By D. S. Colby, F. S. Lott, and B. E. Oppegard

GENERAL SUMMARY

THE PRODUCTION of carbon black in 1949 declined 6 percent to 1,223, 636 thousand pounds, while sales declined 10 percent to 1,125,-410 thousand pounds. Producers' stocks during the year increased 98,218 thousand pounds to 216,461 thousand pounds.

Production decreased in all reporting States except New Mexico. Texas production declined 3 percent, but nevertheless produced 71.5 percent of all carbon black in the country. Contact-black production decreased by nearly 50 million pounds and furnace black by nearly 25 million pounds.

The decline in sales was confined principally to contact grades. Sales of furnace grades declined only 1 percent. Rubber companies purchased 767,131 thousand pounds, 103 million pounds less than in 1948. Sales to ink companies remained virtually unchanged, and paint companies purchased 3 percent more than in 1948. Export sales declined, for the first time since 1943, to 303,244 thousand pounds.

Stocks of contact black held by producers at the end of the year totaled 119,599 thousand pounds, up 91,953 thousand pounds from 1948. Stocks of furnace black increased 6,265 thousand pounds to 96,862 thousand pounds.

Salient statistics of carbon black produced from natural gas and liquid hydrocarbons in the United States, 1945–49

	1945	1946	1947	1948	1949
THOUSAND POUNDS					
Production:					
Contact process (chiefly channel)	538, 539	619. 109	653, 966	677, 133	627, 650
Furnace processes	514, 259	625, 312	664, 999	620, 596	595, 986
Total	1, 052, 798	1, 244, 421	1, 318, 965	1. 297, 729	1, 223, 636
Sales:					
Domestic	846, 262	998, 655	1, 000, 684	932, 433	822, 166
Export	173, 773	271, 085	319, 076	321, 915	303, 244
Total	1, 020, 035	1, 269, 740	1, 319, 760	1, 254, 348	1, 125, 410
Losses	1	458	321	250	8
Stocks of producers Dec. 31	102, 005	76, 228	75, 112	118, 243	216, 461
VALUE					
Production ... thousand dollars	42, 323	59, 988	70, 639	76, 295	74, 685
Average per pound ... cents	4. 02	4. 82	5. 36	5. 88	6. 10

The average yield of carbon black from natural gas declined again, though slightly, to 2.38 pounds per thousand cubic feet. The carbon-black industry consumed 427,892 million cubic feet of natural gas valued at 4.76 cents per thousand cubic feet. This average value is

0.03 cent per thousand above the value in 1948. In addition, 72,387,-000 gallons of liquid hydrocarbons were used as raw material compared with 44,600,000 gallons in 1948.

The average value at plants of all carbon blacks increased from 5.88 cents per pound in 1948 to 6.10 cents in 1949.

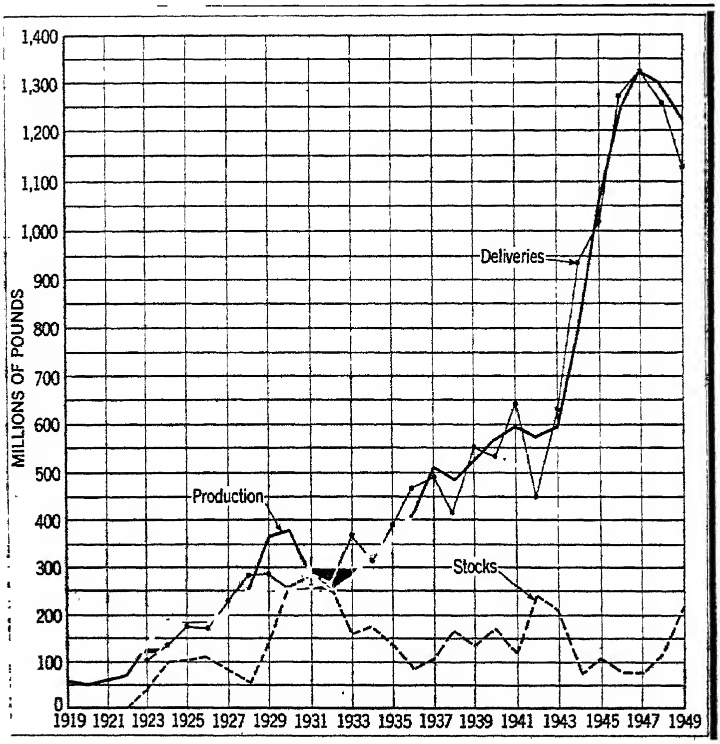

FIGURE 1.—Production, stocks, and deliveries of carbon black, 1919–49.

PRODUCTION

By States.—New Mexico was the only State whose production of carbon black increased in 1949. Production there increased 28 percent to 80,765,000 pounds. This increase, in the face of general production cut-backs, is attributed to the continued low price of gas in New Mexico. Large production declines were reported in Oklahoma (45 percent) and in California and Kansas (31 percent). Production in Texas declined slightly (3 percent), mostly in the Panhandle. Compared with the production of the entire country, the proportion produced by Texas increased nearly 2 percent to 71.5 percent. However, several channel plants in Texas were shut down during the year because of the adverse effect upon their competitive position of relatively high gas costs.

By Months.—Production of carbon black held steady through April 1949, declined rapidly in May and June, and then remained steady until November, when production again started upward. This pattern was followed in general by both contact-black and furnace-black production. Contact-black production declined 7 percent, and furnace-black production dropped 4 percent compared with 1948.

Carbon black produced from natural gas and liquid hydrocarbons in the United States, 1945–49, by States and districts, in thousand pounds

State and district	1945	1946	1947	1948	1949
Louisiana	168,229	191,857	190,252	165,032	160,460
Texas:					
Panhandle district	541,464	596,678	633,250	653,480	625,760
Rest of State	179,974	234,172	262,523	249,904	249,083
Total Texas	721,438	830,850	895,773	903,384	874,843
Other States	163,131	221,714	232,940	229,313	188,333
Grand total	1,052,798	1,244,421	1,318,965	1,297,729	1,223,636

Carbon black produced from natural gas and liquid hydrocarbons in the United States, by States and districts, and natural gas used, in 1949

State and district	Producers reporting [1]	Number of plants	Production: Thousand pounds	Production: Value at plant: Total (thousand dollars)	Production: Value at plant: Average (cents)	Natural gas used: Million cubic feet	Natural gas used: Average yield per M cubic feet of gas (pounds)	Natural gas used: Value: Total (thousand dollars)	Natural gas used: Value: Average per M cubic feet (cents)
California	1	1	80,066	3,509	4.38	14,844	5.39	734	4.94
Kansas	3	4							
Louisiana	6	8	[2] 160,460	6,827	4.25	20,401	6.38	914	4.48
New Mexico	5	5	80,765	5,267	6.52	51,572	1.57	1,985	3.85
Oklahoma	2	3	27,502	1,515	5.51	6,914	3.98	515	7.45
Texas:									
Panhandle district	12	28	[2] 625,760	41,745	6.67	240,566	1.90	12,303	5.11
Rest of State	7	15	[2] 249,083	15,822	6.35	93,595	2.57	3,904	4.17
Total Texas	[1] 15	43	[2] 874,843	57,567	6.58	334,161	2.09	16,207	4.85
Total United States	[1] 21	64	[2] 1,223,636	74,685	6.10	427,892	2.38	20,355	4.76

[1] In counting the total number of producers reporting, a producer operating in more than 1 State, district, or county is counted but once.
[2] Includes carbon black made from liquid hydrocarbons.

Production, shipments, and exports of carbon black in the United States in 1949, by months, in thousand pounds

Month	Production [1]			Shipments (including exports)[1]			Exports [2]		
	Contact	Furnace	Total	Contact	Furnace	Total	Contact	Furnace	Total
January	56,286	49,714	106,000	46,673	47,351	94,024	19,624	9,326	28,950
February	51,585	47,917	99,502	48,429	49,749	98,178	19,310	7,112	26,422
March	57,212	53,784	110,996	47,615	54,224	101,839	22,034	9,366	31,400
April	54,715	52,522	107,237	39,980	49,628	89,608	16,338	11,473	27,811
May	54,364	50,992	105,356	43,014	47,416	90,430	12,843	6,715	19,558
June	49,042	48,895	97,937	42,954	47,670	90,624	10,538	7,399	17,937
July	49,436	49,987	99,423	38,903	45,145	84,048	18,613	8,469	27,082
August	50,084	49,790	99,874	45,610	48,289	93,899	15,823	8,667	24,490
September	48,645	47,612	96,257	41,787	44,319	86,106	14,674	5,474	20,148
October	51,843	47,660	99,503	44,391	53,970	98,361	16,971	7,096	24,067
November	51,725	47,656	99,381	47,000	49,858	96,858	20,753	7,927	28,680
December	52,713	49,457	102,170	49,333	52,102	101,435	17,822	8,877	26,699
Total	627,650	595,986	1,223,636	535,689	589,721	1,125,410	205,343	97,901	303,244

[1] Compiled from reports of the National Gas Products Association and of producing companies not included in the Association figures. Figures adjusted to agree with annual reports of individual producers.
[2] U. S. Department of Commerce.

Methods and Yields.—The average yield of carbon black from natural gas declined slightly in 1949 to 2.38 pounds per thousand cubic feet. This decline was caused by the pronounced reduction in yield of furnace black from natural gas, again probably owing to the production of a larger proportion of the fine-particle-size grades. A yield of 7.44 pounds per thousand cubic feet was obtained in 1949 compared with 8.07 pounds in 1948. The yield of contact blacks from natural gas continues to improve slowly, from 1.61 pounds per thousand cubic feet in 1948 to 1.67 in 1949.

The carbon-black industry consumed 427,892 million cubic feet of natural gas in 1949. Of this, 375,639 million cubic feet were used in the production of contact blacks.

The yield of carbon blacks produced from liquid hydrocarbons in 1949 was estimated to be 2.9 pounds per gallon. The total consumption of liquid hydrocarbons in the production of carbon blacks was 72,387,000 gallons, compared with 44,600,000 in 1948. Almost one-third of the total furnace black produced in 1949 was derived from liquid hydrocarbons, a striking growth made possible by superior quality and wide acceptance of the product of this relatively new process.

Number and Capacity of Plants.—The number of plants that operated during 1949 was 64, one more than in 1948. There were 44 contact-

Yield of carbon black, quantity and value of natural gas used, and number of producers of carbon black in the United States, 1945–49

	1945	1946	1947	1948	1949
Estimated quantity of natural gas used..million cubic feet	431,830	478,349	484,882	480,646	427,892
Average yield of carbon black per thousand cubic feet pounds	2.32	2.44	2.51	2.41	2.38
Average value of natural gas used per thousand cubic feet..cents	2.28	3.02	3.57	4.73	4.76
Number of producers reporting	21	26	22	24	21
Number of plants	59	66	63	63	64

type plants having a total reported capacity of 1,662,000 pounds per day and 20 furnace-type plants with a daily capacity of 2,163,800 pounds. This is a lower channel-type capacity and a slightly higher furnace-type capacity than operated in 1948.

Only one entirely new plant began operating in 1949—a furnace-type plant in Aransas County, Tex., operated by United Carbon Co., Inc. Parts of two channel-type plants were moved to new locations—one from Hutchinson County, Tex., to Richland Parish, La., and one from Moore County, Tex., to Lea County, N. Mex. The plant of Moore County Carbon Co. purchased by United Carbon Co., Inc., was moved from Moore County to Brooks County, Tex.

During 1949, two channel-type plants in Moore County, Tex., were combined; one channel-type plant in Grant County, Kans., a furnace-type plant in Evangeline Parish, La., and six channel-type plants in Texas were shut down. Of these six Texas plants, four are in Hutchinson County, one is on the border between Hutchinson and Carson Counties, and one is in Gray County.

Number and capacity of carbon-black plants operated in the United States, 1948–49

State or district	County or parish	Number of plants				Total daily capacity (pounds)	
		1948		1949			
		Contact	Furnace	Contact	Furnace	1948	1949
California	Contra Costa		1		1	421,800	343,000
Kansas	Grant	2	2	2	2		
Louisiana	Avoyelles		1		1	638,200	584,700
	Evangeline		1		1		
	Ouachita	2	2	2	2		
	Richland	1		2			
Total Louisiana		3	4	4	4	638,200	584,700
New Mexico	Lea	4		5		187,200	289,600
Oklahoma	Texas	1	2	1	2	205,000	205,000
Texas: Panhandle district	Carson	[1] 1		[1] 1		1,862,800	1,569,400
	Gray	6	1	6	1		
	Hutchinson	[1] 13	[2] 3	[1] 12	3		
	Moore	6	1	4	1		
Total Panhandle district		26	5	23	5	1,862,800	1,569,400
Rest of State	Aransas	1	1	1	2	716,800	834,100
	Brazoria	1	1	1	1		
	Brooks			1			
	Ector	1		1			
	Gaines	1		1			
	Harris		1		1		
	Montgomery		1		1		
	Nueces	1		1			
	Reagan	1		1			
	Terry		1		1		
	Ward	1		1			
	Winkler	1		1			
Total rest of State		8	5	9	6	716,800	834,100
Total Texas		34	10	32	11	2,579,600	2,403,500
Total United States		44	19	44	20	4,031,800	3,825,800

[1] One plant in both Carson and Hutchinson Counties tabulated with Hutchinson County.
[2] A plant moved from Hutchinson County, Tex., to Lea County, N. Mex., was counted as 2 plants in 1948.

Producers.—The number of producers in 1949 was 21, 3 less than in the previous year. The Columbian-Phillips Co. was dissolved. Its plant was dismantled and combined with a Columbian Carbon Co. plant. Witco Carbon Co. and Witco Hydrocarbon Corp. took over operation of the two Panhandle Carbon Co. plants. The name of Witco Hydrocarbon Corp. was subsequently changed to Barnhart Hydrocarbon Corp. Imperial Oil & Gas Products Co. sold its plant in 1948 to United Carbon Co., Inc.

DEMAND—SALES

Domestic deliveries of carbon black for all purposes declined 12 percent in 1949 to 822,166,000 pounds. Exports for the year were 303,244,000 pounds, resulting in a total demand of 1,125,410 pounds, 10 percent below that in 1948.

The trend of domestic sales by months was slightly downward for furnace blacks and steeply downward for contact blacks through September, after which sales of both types improved.

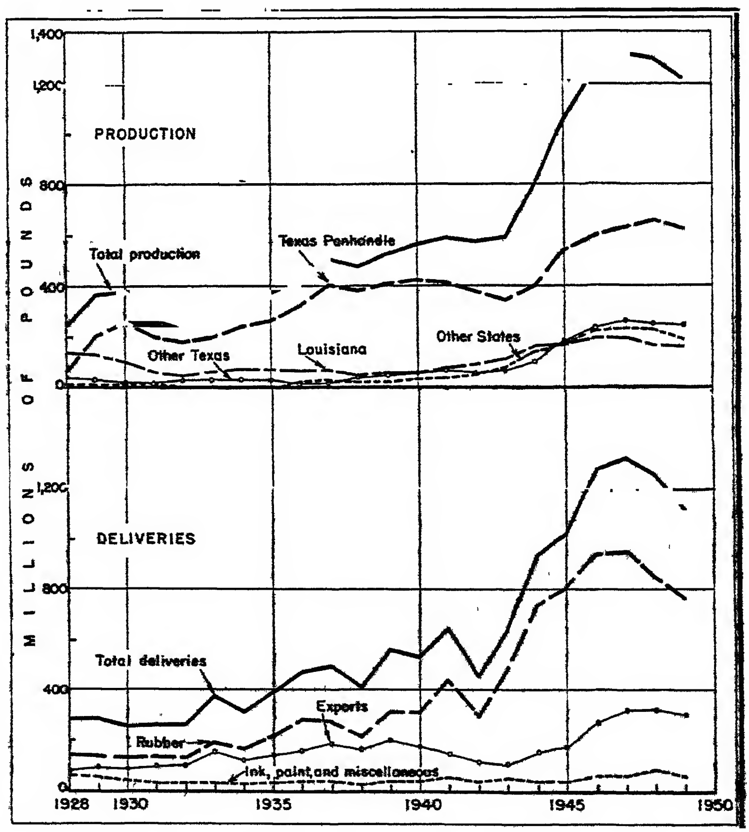

FIGURE 2.—Production and deliveries of carbon black, 1928–49. Production in "Other Texas" includes Oklahoma and Wyoming in 1932–35.

Total demand for furnace black in 1949 accounted for 52 percent of the demand for all types compared with 48 percent in 1948. Demand for furnace black decreased by 1 percent in 1949, while demand for contact types decreased by 19 percent. The renewed interest in furnace black can probably be attributed to the production of types more suitable for use in natural rubber.

The rubber industry again in 1949 consumed 93 percent of all carbon black sold domestically. Sales of carbon black to rubber companies decreased 12 percent, while consumption of virgin rubber declined 8 percent and reclaimed rubber declined 19 percent. If it is assumed, as in previous years, that 347 pounds of carbon black were consumed per long ton of reclaimed rubber, the carbon-black loading of virgin rubber in the United States was 698 pounds per long ton. This compares closely with a calculated loading of 706 pounds per long ton in 1948, as would be expected since the ratio of synthetic rubber to total virgin-rubber consumption remained unchanged at 0.42.

Sales of carbon black to ink manufacturers decreased 1 percent to 32,054,000 pounds. At the same time, newsprint consumption increased 8 percent to 5,529,000 tons, according to the American Newspaper Publishers Association.

The paint industry consumed 7,005,000 pounds of carbon black in 1949, 3 percent above 1948. The over-all output of the paint industry declined 6 percent.

Sales of carbon black for domestic consumption in the United States, by uses, 1945–49, in thousand pounds

Use	1945	1946	1947	1948	1949
Rubber	804,386	941,464	943,580	870,564	767,131
Ink	22,824	29,561	32,260	32,436	32,054
Paint	7,421	9,312	8,137	6,799	7,005
Miscellaneous	11,631	18,318	16,707	22,634	15,976
Total	846,262	998,655	1,000,684	932,433	822,166

STOCKS

Producers' stocks of carbon black rose throughout the year from 118,243,000 pounds on December 31, 1948, to 216,461,000 pounds at the end of 1949. This rise almost entirely affected stocks of contact blacks, which rose from a 16-day supply of 27,646,000 pounds at the beginning of 1949 to a 75-day supply of 119,599,000 pounds at the end of the year. The increases in these stocks during the last 2 months of 1949 were not as great as during the earlier part of the year.

Stocks of furnace blacks at the beginning of 1949 were 90,597,000 pounds, rising to 107,618,000 pounds in September and then declining to 96,862,000 pounds at the year end. The days' supply at the end of the year was 58 compared with 54 at the end of 1948.

Stocks of contact and furnace-type blacks held by producers as of December 31, 1944–49, were as follows, in pounds:

Year	Contact types	Furnace types	Total
1944 -----	58, 036, 000	11, 207, 000	69, 243, 000
1945 -----	64, 956, 000	37, 049, 000	102, 005, 000
1946 -----	17, 006, 000	59, 222, 000	76, 228, 000
1947 -----	8, 619, 000	66, 493, 000	75, 112, 000
1948 -----	27, 646, 000	90, 597, 000	118, 243, 000
1949 -----	119, 599, 000	96, 862, 000	216, 461, 000

PRICES

The average value of all carbon black produced in the United States in 1949 was 6.10 cents per pound f. o. b. producing plants compared with 5.88 cents in 1948. Contact blacks declined 0.06 cent per pound to 7.22 cents, while the average value of natural gas consumed at contact plants advanced 0.05 cent per thousand cubic feet to 4.74 cents.

The average value of furnace blacks increased from 4.35 cents per pound f. o. b. producing plants in 1948 to 4.92 cents in 1949. This rise in average value may have been caused in part by the production of a greater proportion of the fine-particle-size furnace blacks. The average value of natural gas consumed at furnace plants declined 0.07 cent per thousand cubic feet to 4.89 cents. The value of liquid hydrocarbons feedstock, for which figures are not available, is also an important factor in the average value of furnace blacks.

Oil, Paint and Drug Reporter on January 7, 1949, published a price increase of 0.08 cent per pound to 7.40 cents per pound for ordinary rubber grades of channel black in bags and fine furnace black in bags. On July 1, 1949, a price reduction of 0.50 cent per pound was reported for the ordinary rubber grades both in bags and bulk. This quotation places the price of these grades of channel black below that of fine furnace black for the first time since comparative prices have been available.

Prices of carbon black in carloads, f. o. b. plant, 1946–49, in cents per pound

[Oil, Paint and Drug Reporter]

Date of change	Channel blacks		Furnace blacks		
	Ordinary rubber grades [1]		Semireinforcing grades (SRF)	High modulus grades (HMF)	Fine grades (FF)
	Bags	Bulk	Bags	Bags	Bags
Jan. 1, 1946 [2]	5.25	5.00	3.50	5.00	----------
Oct. 1, 1946 [2]	5.75	5.50	3.50	5.00	----------
Jan. 1, 1947	6.32	6.00	3.50	5.00	6.00
Oct. 1, 1947	6.32	6.00	3.50	5.00	6.00
Jan. 1, 1948	6.82	6.50	3.50	5.00	6.50
Apr. 1, 1948	7.32	7.00	3.50	5.00	7.32
Jan. 7, 1949	7.40	7.00	3.50	5.00	7.40
July 1, 1949	6.90	6.50	3.50	5.00	7.40

[1] Chiefly easy-processing (EPC) and medium-processing (MPC) but also includes hard-processing (HPC) and conductive (CC) channel blacks.

[2] Office of Price Administration ceiling prices. Average realization on sales to the Rubber Reserve Company was generally higher.

FOREIGN TRADE [1]

Imports.—Imports of carbon black in 1949 consisted of 7,851,490 pounds from Canada, 409 pounds from Sweden, and 200 pounds from the United Kingdom. The Canadian imports consisted of 96,075 pounds of "gas black and carbon black" valued at 12.2 cents per pound and 7,755,415 pounds of "acetylene black" valued at 12.5 cents per pound. Both the quantity and unit value of acetylene black imports decreased from 1948, when they were 10,145,681 pounds at 12.7 cents per pound.

Exports.—Exports of carbon black declined in 1949 6 percent to 303,244,000 pounds. Export figures, by type of black, were available for the first time in 1949. Contact blacks comprised 68 percent of the

Carbon black exported from the United States, 1947–49, by countries

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Pounds	Value	Pounds	Value	Pounds	Value
Argentina	10,112,153	$905,655	5,764,671	$551,665	5,350,195	$496,501
Australia	15,159,188	1,412,446	15,155,026	1,396,873	20,938,320	1,900,144
Austria	493,650	33,585	1,910,300	162,663	3,442,650	302,610
Belgium-Luxembourg	11,928,375	1,082,997	6,718,745	697,691	4,951,585	494,972
Brazil	11,341,072	929,282	8,810,209	816,433	13,674,097	1,200,202
Canada	56,382,871	3,050,370	51,620,189	3,094,028	43,912,566	2,682,604
Chile	1,129,875	100,488	1,434,215	124,624	1,566,437	154,671
China	1,544,745	149,277	825,659	88,428	90,575	8,564
Colombia	1,673,236	138,953	1,043,288	98,623	1,431,408	137,998
Cuba	1,198,260	81,238	272,240	24,225	410,950	34,130
Czechoslovakia	2,217,088	157,982	436,250	42,319	--------	--------
Denmark	1,736,500	167,765	2,925,915	293,939	680,550	78,022
Finland	615,875	59,184	1,098,350	104,155	672,300	60,507
France	37,541,122	2,934,075	46,481,544	4,219,264	53,869,361	5,065,492
Germany	--------	--------	1,416,100	135,742	1,772,564	187,865
Hong Kong	413,958	36,877	143,625	16,331	510,626	60,131
Hungary	425,950	37,159	367,250	35,911	5,000	270
India and Pakistan	7,625,445	606,891	13,033,382	1,218,818	6,692,100	547,473
Indonesia	975,600	75,358	1,982,276	187,290	2,242,654	188,869
Ireland	1,386,313	142,895	1,125,675	121,617	1,430,190	143,850
Italy	19,078,369	1,451,272	10,580,964	990,569	12,840,070	1,275,246
Japan	50,000	6,000	3,570,100	281,752	10,958,200	1,010,570
Korea	--------	--------	242,900	16,425	825,234	46,769
Malaya	728,050	55,695	144,250	13,982	358,750	32,646
Mexico	6,364,681	381,824	8,949,796	624,814	8,039,820	572,074
Netherlands	4,414,944	452,962	3,955,110	361,290	5,583,626	559,820
New Zealand	2,293,591	187,447	1,654,652	162,251	1,787,650	156,666
Norway	1,384,170	125,924	1,386,950	129,174	1,338,100	119,597
Peru	770,410	66,315	863,813	76,527	998,706	89,221
Poland—Danzig	448,000	36,065	--------	--------	--------	--------
Portugal	714,742	65,591	394,650	41,618	982,950	90,629
Spain	3,199,225	266,665	4,314,850	412,207	2,029,550	188,526
Sweden	7,150,399	636,061	5,019,042	464,227	5,143,502	480,461
Switzerland	1,686,840	145,326	2,789,369	270,445	3,081,001	294,004
Turkey	269,100	52,956	497,600	38,626	599,250	45,168
Union of South Africa	11,625,340	1,284,300	11,208,660	1,013,913	12,019,829	1,121,695
U. S. S. R.	500,000	25,000	--------	--------	--------	--------
United Kingdom	91,891,486	9,320,271	102,379,289	10,057,257	71,665,770	6,845,735
Uruguay	875,550	74,040	172,525	16,197	372,320	32,789
Venezuela	359,939	28,501	403,820	31,953	293,690	26,357
Yugoslavia	550,500	22,085	110,230	17,136	109,950	10,555
Other countries	839,112	61,859	711,100	72,523	563,125	56,554
Total	319,075,706	26,848,636	321,914,579	28,523,515	303,244,221	26,799,957

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

exports compared with 40 percent of the domestic demand. The unit value of the exports was 8.84 cents per pound, virtually unchanged from the 1948 value of 8.86 cents.

Substantial increases were made in the quantities exported to France, Japan, Australia, and Brazil. France in 1949 was second only to the United Kingdom as an importer of American carbon black. Canada in 1949 dropped from second to third place.

Exports to the United Kingdom decreased by 31 million pounds and to Canada by 8 million pounds in 1949. Exports to the U. S. S. R. and its satellites—that is, China, Czechoslovakia, Hungary, and Poland—have stopped entirely or diminished to negligible amounts.

Current construction of carbon-black plants in the United Kingdom will undoubtedly cause further loss of export markets by 1951.

TECHNOLOGY

Two interrelated trends seem to be in progress in the carbon-black industry. One, already assuming importance, is the production of better furnace blacks. The other, still in the future, is dispersion of producing plants in this country and throughout the world.

Furnace blacks are being produced with reinforcing properties equivalent to or exceeding those of channel blacks. These can be produced more readily from liquid-petroleum fuels than from natural gas. These blacks are preferred over channel blacks for compounding with synthetic rubber stocks. Processing techniques and compounding formulations are being developed which produce desirable properties when these furnace blacks, in conjunction with channel black, are used in natural rubber stocks. The major difficulty in processing stocks incorporating furnace black is their low-scorch resistance, caused by the alkalinity and resultant low accelerator adsorption of these blacks.

The higher operating efficiency that can be achieved in the furnace process, about 50 percent for oil feed and 20 percent for gas feed, as compared to the 5-percent recovery with the channel process, makes this process more stable economically in the face of rising natural-gas costs.

Furnace plants using a liquid feedstock will not be tied to the gas fields as are the channel plants. Other economic factors can then determine the location of these plants. In some cases rail freight charges on carbon black from the gas fields to the rubber processing plant will be greater than transportation charges on equivalent liquid feed to a furnace plant at the rubber processing center. If the practice of incorporating carbon black in rubber latex becomes more common, furnace plants might advantageously be located at synthetic rubber plants or at the natural rubber plantation.

The two plants under construction in England to produce furnace black from liquid petroleum are indicative of the newly achieved independence of such facilities from natural-gas fields. These will begin production in 1951.

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WORLD REVIEW

The production of carbon black in countries other than the United States has been of minor importance. Before World War II a plant in the Baku oil fields of Russia produced about 2,000 tons per year, and small plants operated in Rumania, Czechoslovakia, and Yugoslavia. Recent production statistics are not available from these countries. Prewar Germany was the largest foreign producer, making about 30,000 tons a year from coal byproducts. Western Germany probably will produce around 20,000 tons in 1950 Austria is reported to be experimenting on the manufacture of carbon black from coal. England in the post-World War II years produced about 5,000 tons a year of lamp black, most of which was used in rubber compounding. Carbon black plants currently under construction in England will have a capacity of over 30,000 tons a year. The United States export market may be reduced by a corresponding quantity.

Cement

By D. G. Runner and Esther V. Balser

GENERAL SUMMARY

PRODUCTION of cement in 1949 increased over the previous year's total. Demand for cement during the year resulted in another record-breaking output, as 212,912,646 barrels of hydraulic cement were produced—2 percent more than in 1948. Nevertheless, production of one group of hydraulic cements (natural, masonry, and puzzolan cements) decreased slightly from the 1948 output. The portland-cement industry operated at 81 percent and the remainder of the hydraulic cement industry at 90 percent of productive capacity during 1949. Mill shipments of portland cement, which totaled 206,080,325 barrels, represented an increase of 1 percent over the 1948 figure—an all-time record. Shipments of other hydraulic cements decreased 4 percent. Stocks of all hydraulic cements on hand at mills December 31, 1949, amounted to 14,902,387 barrels, 32 percent greater than at the end of 1948.

The average net mill realization per barrel of portland cement reached $2.30—an increase of 12 cents above the average 1948 price. Other hydraulic cements, as a group, reported a gain of 19 cents a barrel to $2.48.

The long-term trend, as indicated by the moving 12-month total of production of finished portland cement in the Bureau of Mines Monthly Cement Reports, indicated a leveling-off stage, but at a slightly higher plane than in 1948.

Monthly production during 1949 amounted to 15.3 million barrels in January, declined slightly in February, increased gradually to May, and alternately declined and increased for the next 4 months to a high of 19.2 million barrels in September. From this point onward production declined to a year-end low of 17.0 million barrels. The monthly average for the year exceeded 17 million barrels.

Monthly shipments from mills in 1949 exceeded those for 1948 in only 5 months and reached a high in August 1949 compared to a high in June in the previous year. Shipments amounted to 8.8 million barrels in January, increased steadily to 20.7 million barrels in June, decreased in July, and reached the maximum of 23.6 million barrels in August, from which point the shipments decreased gradually to a year-end figure of 11.6 million barrels.

Without exception, stocks for each month of 1949 exceeded those for 1948. Finished cement on hand at the end of January 1949 amounted to 17.6 million barrels, and the maximum reached during the year totaled 23.1 million barrels in March. The low for the year was in October, at which time 8.6 million barrels were in stock.

Consumption of portland cement in 1949, as indicated in figure 1, shows that the Middle States is the largest consuming area.

TABLE 1.—Salient statistics of the cement industry in the United States, 1945–49 [1]

	1945	1946	1947	1948	1949
Production:					
Portland........barrels..	102,804,884	164,064,188	186,519,347	205,448,263	209,727,417
Masonry, natural, and puzzolan (slag-lime)........barrels..	1,483,763	2,474,674	2,951,098	3,440,248	3,185,229
Total........do....	104,288,647	166,538,862	189,470,445	208,888,511	212,912,646
Capacity used at portland-cement mills........percent..	42.5	67.9	74.9	80.8	81.0
Shipments from mills:					
Total........barrels..	107,833,108	172,100,699	190,419,754	207,679,797	209,313,850
Value of shipments [2]........	$175,430,858	$296,551,514	$361,978,374	$453,412,362	$481,183,393
Average value per barrel........	$1.63	$1.72	$1.90	$2.18	$2.30
Stocks at mills, Dec. 31........barrels..	16,625,099	11,081,786	10,157,015	[3] 11,303,591	14,902,387
Imports........do....	323	3,734	4,606	[3] 282,752	109,821
Exports........do....	6,474,721	5,163,362	[4] 6,771,250	5,922,163	4,561,899
Apparent consumption [5]........do....	101,358,710	166,941,071	[4] 183,454,387	[3] 202,040,386	204,861,772
World production (estimated)........do....	291,312,000	425,898,000	498,580,000	583,082,000	652,585,000

[1] Figures include Puerto Rico and Hawaii.
[2] Value received f. o. b. mill, excluding cost of containers.
[3] Revised figure.
[4] 198,723 barrels, valued at $839,916, shipped under the U. S. Army Civilian Supply Program, is excluded from exports shown but deducted from apparent consumption.
[5] Shipments from domestic mills minus net exports.

States in the regions shown in figure 1 are as follows: Northeastern—Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; Southern—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; Middle—Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; Rocky Mountain—Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming; Pacific—California, Oregon, and Washington.

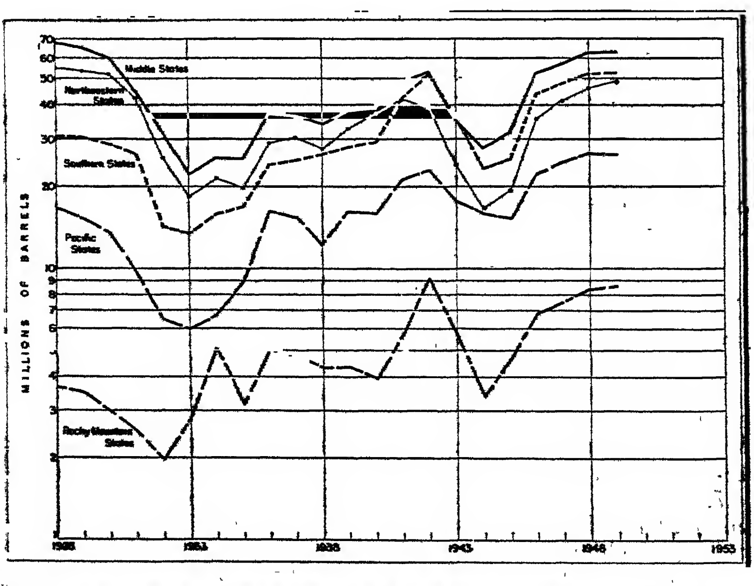

FIGURE 1.—Trends in indicated consumption of portland cement in continental United States, 1928–49, by regions.

In spite of the coal strike during part of the year, shortages of cement that developed were largely localized; and, in general, the supply situation was not critical. The program of rehabilitation and expansion of cement plants that began after World War II continued in 1949. A dry-process plant of the Arizona Portland Cement Co., Los Angeles, Calif., was put into operation at Rillito, Ariz.—the first in that State.[1] Progress has been made on construction of the Corpus Christi, Tex., plant of the Halliburton Portland Cement Co., and it was planned to begin operating by the end of 1949.[2] The possibility of building a cement plant in North Carolina, at present a non-cement-producing State, is being investigated by the State Portland Cement Commission. In a report to the Governor it was recommended that exploratory studies of raw materials be made, particularly around Castle Hayne, and in the general areas of known limestone deposits.[3] Small-scale production of cement has been accomplished in the laboratories of North Carolina State College, using native raw materials.[4] The possibility of establishing a cement plant in North Dakota, also a non-cement-producing State, was investigated during the year.[5] Preliminary research has indicated that there is enough raw material near Colgrove Butte, N. Dak., with which to operate a cement plant.[6]

Many companies improved existing installations during the year. Such improvements included the addition of new kilns, coolers, slurry tanks, and other equipment necessary to maintain or increase production. The Portland Point, N. Y., plant of the Pennsylvania-Dixie Cement Corp., and the Kenova, W. Va., plant of the Green Bag Cement Co. of West Virginia were inactive in 1949.

The uncertainties in cement-industry pricing practice created by the United States Supreme Court decision of April 26, 1948, remained during 1949. The consensus of the industry appears to be that delivered pricing is defensible where no collusion exists but that f. o. b. plant pricing is more certain to be acceptable to the Federal Trade Commission. The basing-point problem was given a great deal of consideration by Congress[7] and by the press[8] during the year.

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[1] Pit and Quarry, Arizona's Own Portland Cement Plant: Vol. 43, No. 1, July 1950, p. 89.
[2] Rock Products, vol. 52, No. 8, August 1949, p. 90.
[3] Pit and Quarry, vol. 42, No. 4, October 1949, p. 58.
[4] Chemical Engineering Progress, vol. 45, No. 3, March 1949, p. 20.
[5] Pit and Quarry, vol. 41, No. 10, April 1949, p. 61.
[6] Rock Products, North Dakota Plans State Cement Plant: Vol. 52, No. 4, April 1949, p. 81.
[7] Hearings before the Select Committee on Small Business, House of Representatives, 81st Congress, First Session: Small Business Objections on Basing-Point Legislation, particularly S. 1008, June 28, 29, 30, July 1, and 5, 1949, Government Printing Office, 303 pp.
[8] Rock Products, vol. 52, No. 1, January 1949, p. 53. Mining Congress Journal, vol. 35, No. 2, February 1949, p. 123; vol. 35, No. 7, July 1949, p. 55.
Sunderland, Lester T., Impact of Basing-Point Decision: Rock Products, vol. 52, No. 8, August 1949, pp. 152-154, 189. Rock Products, vol. 52, No. 9, September 1949, p. 51.

PRODUCTION, SHIPMENTS, AND STOCKS

PORTLAND CEMENT

Portland cement, which constituted 99 percent of the entire output of hydraulic cements in 1949, was manufactured and shipped from 150 plants in 36 States and Puerto Rico. One new plant in Arizona began operating in December 1949.

In 1949 production was greater in 12 of the 19 districts than in 1948. The changes from 1948 figures ranged from a decrease of 10 percent in the Puerto Rican district to an increase of 19 percent in the Virginia-Georgia-Florida-Louisiana-South Carolina district. Quantitywise, the Eastern Pennsylvania-Maryland district led with an output of 33,799,369 barrels followed by California, which reported the production of 23,218,356 barrels. Other districts producing more than 10 million barrels in 1949 were: New York-Maine, Ohio, Michigan, Indiana-Kentucky-Wisconsin, and Texas. These seven districts supplied 58 percent of the total output.

Shipments from districts in 1949 were greater in nine districts than in 1948. The percentage changes ranged from a decrease of 12 for the Tennessee district to an increase of 19 for the Virginia-Georgia-Florida-Louisiana-South Carolina district. An 11-percent decrease was recorded in the Puerto Rican district.

Stocks of finished cement were 33 percent greater on December 31, 1949, than on the same date in 1948. Without exception, all districts showed increases in stocks at the year end over the preceding year, and these increases ranged from 2 percent in the Michigan, Western Missouri-Nebraska-Oklahoma-Arkansas, and California districts to 119 percent in the Alabama district. The trend of month-end stocks of clinker in 1949 followed essentially the same pattern as in 1948, when the peak was reached in March and the low developed in November.

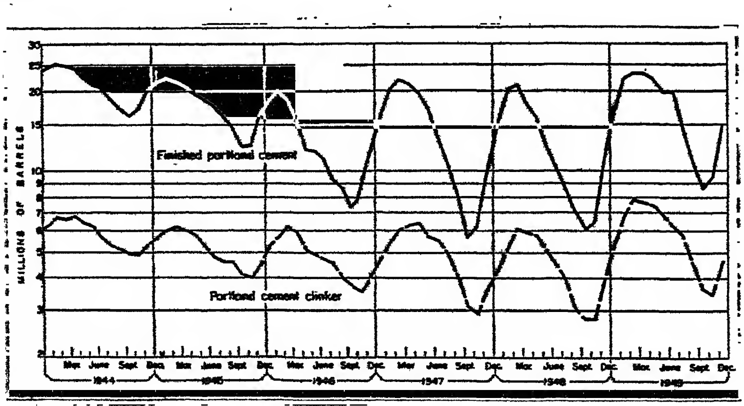

FIGURE 2.—Trends in end-of-month stocks of finished cement and portland-cement clinker, 1944-49.

TABLE 2.—Finished portland cement produced, shipped, and in stock in the United States, 1948–49, by districts

District	Active plants		Production			Shipments from mills								Stocks at mills on Dec. 31		
			Barrels		Percent change from 1948	1948			1949					Barrels		Percent change from 1948
						Barrels	Value		Barrels	Value		Percent change from 1948 in—				
	1948	1949	1948	1949			Total	Average		Total	Average	Barrels	Average value	1948 [1]	1949	
Eastern Pennsylvania, Maryland	21	21	33,589,877	33,799,369	+0.6	33,518,779	$71,150,988	$2.12	32,956,324	$75,344,266	$2.29	−1.7	+8.0	1,728,689	2,571,734	+48.8
New York, Maine	11	11	13,504,096	13,838,715	+2.5	13,475,277	28,825,985	2.14	13,737,319	31,009,863	2.26	+1.9	+5.6	1,014,835	1,116,231	+10.0
Ohio	9	9	10,035,211	10,318,496	+2.8	10,020,198	20,496,930	2.05	10,157,001	22,388,726	2.20	+1.4	+7.3	600,020	756,515	+26.1
Western Pennsylvania, West Virginia	8	7	8,940,151	8,930,125	−0.1	8,931,245	18,518,280	2.07	8,541,756	19,105,498	2.24	−4.4	+8.2	570,207	958,576	+68.1
Michigan	7	7	11,410,085	12,767,500	+11.9	11,116,911	23,533,001	2.12	12,747,791	28,823,055	2.26	+14.7	+6.6	1,184,758	1,204,467	+1.7
Illinois	4	4	7,570,536	8,127,656	+7.4	7,573,404	15,200,723	2.01	7,976,972	16,645,730	2.09	+5.3	+4.0	478,660	629,350	+31.5
Indiana, Kentucky, Wisconsin	6	6	12,333,325	12,683,409	+2.8	12,153,061	24,479,875	2.01	12,433,483	25,506,156	2.06	+2.3	+2.5	758,927	1,008,853	+32.9
Alabama	7	7	9,908,219	9,721,542	−1.9	9,948,600	20,140,177	2.02	9,394,348	20,320,658	2.16	−5.6	+6.9	274,577	601,771	+119.2
Tennessee	6	6	6,727,160	6,077,549	−9.7	6,774,926	13,667,060	2.02	5,992,571	12,857,600	2.15	−11.5	+6.4	211,699	296,677	+40.1
Virginia, Georgia, Florida, Louisiana, South Carolina	7	7	7,134,091	8,505,552	+19.2	7,058,877	16,201,937	2.30	8,412,037	20,122,022	2.39	+19.2	+3.9	284,230	377,745	+32.9
Iowa	5	5	6,807,214	6,834,445	+0.4	6,835,578	14,424,526	2.11	6,655,208	14,602,554	2.19	−2.6	+3.8	473,718	652,955	+37.8
Eastern Missouri, Minnesota, South Dakota	6	6	9,654,828	9,867,811	+2.2	9,649,881	20,740,674	2.15	9,452,303	21,601,203	2.29	−2.0	+6.5	477,478	892,986	+87.0
Kansas	6	6	7,933,899	7,824,620	−1.4	7,930,965	16,188,379	2.04	7,640,540	16,880,156	2.21	−3.7	+8.3	271,798	455,878	+67.7
Western Missouri, Nebraska, Oklahoma, Arkansas	6	6	6,960,886	7,412,145	+6.5	6,860,520	14,528,697	2.12	7,403,827	16,418,363	2.22	+7.9	+4.7	380,620	388,938	+2.2
Texas	10	10	13,700,688	14,949,812	+9.1	13,786,846	30,352,972	2.20	14,741,805	33,409,347	2.27	+6.9	+3.2	429,334	637,341	+48.4
Colorado, Arizona,[2] Wyoming, Montana, Utah, Idaho	9	10	5,456,272	6,261,861	+14.8	5,250,131	14,314,150	2.73	6,149,542	17,227,366	2.80	+17.1	+2.6	382,550	494,875	+29.4
California	11	11	24,601,892	23,218,356	−5.6	24,162,926	57,742,226	2.39	23,201,982	57,464,213	2.48	−4.0	+3.8	1,056,126	1,072,500	+1.6
Oregon, Washington	9	9	6,740,050	6,401,510	−5.0	6,816,082	18,224,466	2.67	6,314,030	17,281,215	2.74	−7.4	+2.6	403,008	580,488	+17.7
Puerto Rico	2	2	2,440,888	2,191,944	−10.2	2,440,455	6,947,027	2.85	2,171,486	6,109,041	2.81	−11.0	−1.4	22,444	42,002	+91.2
Total	150	150	205,448,263	209,727,417	+2.1	204,304,662	445,678,073	2.18	206,080,325	473,177,032	2.30	+0.9	+5.5	11,093,690	14,740,782	+32.9
Pennsylvania	24	24	38,810,697	38,122,065	−0.5	38,255,543	81,638,484	2.13	36,905,254	84,839,175	2.30	−3.5	+8.0	2,056,756	3,273,567	+59.2
Missouri	5	5	8,503,012	8,791,943	+3.4	8,428,343	17,911,257	2.13	8,518,636	19,347,814	2.27	+1.1	+6.6	458,468	731,775	+59.6

[1] Revised figures.
[2] Arizona first began operating in December 1949.

TABLE 8.—Production, shipments from mills, and stocks at mills of finished portland cement in the United States in 1949, by months and districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania, Maryland	2,650	2,390	2,660	2,797	2,914	2,749	2,922	3,078	2,987	3,115	2,874	2,685
New York, Maine	1,030	854	913	967	1,067	1,214	1,343	1,327	1,418	1,349	1,227	1,137
Ohio	744	556	746	909	987	925	870	975	999	944	815	842
Western Pennsylvania, West Virginia	750	707	728	719	694	720	702	713	817	946	787	647
Michigan	561	391	354	1,152	1,436	1,417	1,430	1,136	1,369	1,414	1,164	944
Illinois	681	560	577	709	726	658	681	703	758	782	711	629
Indiana, Kentucky, Wisconsin	878	1,027	847	1,169	1,206	1,198	1,206	1,244	1,320	721	1,000	921
Alabama	830	736	822	849	856	751	773	822	808	826	857	790
Tennessee	538	406	479	469	527	491	523	532	434	581	552	546
Virginia, Georgia, Florida, Louisiana, South Carolina	736	629	653	714	719	717	734	721	733	743	705	707
Iowa	542	425	437	493	539	632	624	648	672	695	562	574
Eastern Missouri, Minnesota, South Dakota	631	703	852	834	880	846	876	895	898	824	788	833
Kansas	479	525	624	639	762	691	669	680	705	708	703	595
Western Missouri, Nebraska, Oklahoma, Arkansas	584	482	476	641	672	578	689	548	681	715	705	641
Texas	1,090	1,092	1,152	1,261	1,242	1,262	1,287	1,344	1,315	1,307	1,272	1,357
Colorado, Arizona,[1] Wyoming, Montana, Utah, Idaho	351	279	482	506	488	520	653	570	605	656	583	549
California	1,653	1,593	1,828	2,006	2,042	2,066	2,011	2,081	2,031	1,936	2,032	1,939
Oregon, Washington	354	208	590	649	652	636	657	594	604	563	436	427
Puerto Rico	229	188	219	199	213	199	206	104	27	185	217	204
United States: 1949	15,201	13,751	15,439	17,682	18,622	18,279	18,856	18,715	19,181	19,070	18,040	16,967
1948	14,541	13,347	14,502	16,041	17,740	17,757	18,721	18,961	18,605	19,349	18,435	17,425
SHIPMENTS												
Eastern Pennsylvania, Maryland	1,612	1,603	2,373	2,811	2,892	3,297	3,156	3,656	3,544	3,363	2,745	1,909
New York, Maine	545	487	763	1,181	1,394	1,603	1,436	1,649	1,520	1,449	1,053	656
Ohio	343	389	612	810	914	1,018	955	1,198	1,191	1,405	855	469
Western Pennsylvania, West Virginia	278	304	484	677	785	931	825	1,060	1,042	1,036	694	419
Michigan	263	256	479	907	1,251	1,452	1,458	1,845	1,747	1,626	1,008	455
Illinois	191	215	494	753	856	872	713	1,005	1,093	896	619	270
Indiana, Kentucky, Wisconsin	435	468	877	1,048	1,246	1,327	1,372	1,725	1,656	909	834	591
Alabama	681	625	752	722	805	780	761	937	854	908	921	650
Tennessee	349	334	472	529	526	514	492	599	607	600	551	417
Virginia, Georgia, Florida, Louisiana, South Carolina	550	547	662	718	792	763	772	794	791	743	653	628
Iowa	135	201	462	623	760	802	648	789	839	775	449	180
Eastern Missouri, Minnesota, South Dakota	208	302	656	809	901	938	818	1,265	1,413	1,057	730	356
Kansas	132	192	494	752	705	718	711	918	823	945	836	413
Western Missouri, Nebraska, Oklahoma, Arkansas	247	270	599	752	772	678	667	763	719	783	722	432

Texas	879	834	1,235	1,220	1,371	1,294	1,162	1,513	1,426	1,308	1,401	1,129
Colorado, Arizona,[1] Wyoming, Montana, Utah, Idaho	149	201	458	581	589	685	592	664	689	678	567	298
California	1,437	1,490	1,844	2,050	1,994	2,053	1,880	2,356	2,155	2,069	2,002	1,881
Oregon, Washington	131	220	583	647	652	738	703	778	630	555	420	272
Puerto Rico	193	196	240	189	221	204	200	119	24	173	209	203
United States: 1949	8,756	9,134	14,539	17,779	19,426	20,667	19,321	23,633	22,763	21,278	17,269	11,628
1948	9,205	8,338	13,957	19,047	19,544	21,426	20,994	20,705	19,938	20,324	18,110	12,741
STOCKS (END OF MONTH)												
Eastern Pennsylvania, Maryland	2,753	3,539	3,826	3,811	3,833	3,285	3,051	2,473	1,915	1,666	1,795	2,570
New York, Maine	1,528	1,896	2,045	1,811	1,481	1,091	995	660	557	459	633	1,114
Ohio	1,023	1,191	1,324	1,424	1,497	1,404	1,320	1,098	906	422	383	757
Western Pennsylvania, West Virginia	1,042	1,444	1,688	1,729	1,638	1,427	1,303	957	731	641	734	962
Michigan	1,483	1,617	1,493	1,737	1,923	1,888	1,859	1,151	773	560	716	1,204
Illinois	920	1,265	1,348	1,304	1,174	960	929	627	291	178	270	629
Indiana, Kentucky, Wisconsin	1,193	1,752	1,721	1,844	1,805	1,676	1,510	1,030	697	512	678	1,008
Alabama	423	534	604	732	783	755	767	651	606	524	461	602
Tennessee	401	473	480	419	419	396	427	360	187	168	168	297
Virginia, Georgia, Florida, Louisiana, South Carolina	470	553	543	539	466	419	378	305	247	247	299	378
Iowa	880	1,104	1,080	950	728	558	534	393	226	145	258	653
Eastern Missouri, Minnesota, South Dakota	902	1,302	1,499	1,524	1,503	1,415	1,474	1,104	589	355	413	890
Kansas	618	951	1,082	957	1,014	986	944	705	585	407	274	456
Western Missouri, Nebraska, Oklahoma, Arkansas	717	930	807	696	506	497	519	304	265	198	181	389
Texas	641	899	815	857	727	695	820	650	539	538	410	638
Colorado, Arizona,[1] Wyoming, Montana, Utah, Idaho	585	663	687	612	512	356	417	324	240	217	244	495
California	1,243	1,346	1,330	1,287	1,335	1,348	1,478	1,202	1,078	946	975	1,034
Oregon, Washington	710	696	702	704	704	602	555	369	344	352	418	573
Puerto Rico	59	51	30	40	32	27	33	18	21	34	42	43
United States: 1949	17,591	22,206	23,104	22,977	22,170	19,785	19,313	14,381	10,797	8,569	9,352	14,691
1948	15,336	20,340	20,886	17,880	16,086	12,422	10,149	8,355	7,061	6,094	6,399	[2] 11,084

[1] Arizona first started operating in December 1949.
[2] Revised figure.

TABLE 4.—Stocks of finished portland cement and portland-cement clinker at mills in the United States [1] on Dec. 31, and yearly range in end-of-month stocks, 1945–49

		Dec. 31 (barrels)	Range			
			Low		High	
			Month	Barrels	Month	Barrels
1945	Cement	16,454,775	October	12,385,000	February	22,171,000
	Clinker	4,462,633	November	4,022,000	March	6,185,000
1946	Cement	10,969,755	October	7,298,000	February	20,034,000
	Clinker	3,886,443	November	3,512,000	March	6,281,000
1947	Cement	10,011,607	October	5,668,000	do	22,178,000
	Clinker	3,605,299	November	2,929,000	May	6,353,000
1948	Cement	[2] 11,093,690	October	6,094,000	March	20,886,000
	Clinker	[2] 3,781,250	November	2,781,000	do	6,072,000
1949	Cement	14,740,782	October	8,569,000	do	23,104,000
	Clinker	4,577,212	November	3,387,000	do	7,764,000

[1] Includes Puerto Rico and Hawaii.
[2] Revised figure.

NATURAL, MASONRY (NATURAL), AND PUZZOLAN CEMENTS

Hydraulic cements, other than portland, were produced in 9 plants in 1949. Output, shipments, and stocks during the year were, respectively, 7, 4, and 23 percent less than in 1948. Producers reported the consumption of 41,783 short tons of coal and 224,434,000 cubic feet of gas (equivalent to approximately 4,694 short tons of coal). Statistics for the 5-year period 1945–49 are shown in the following table.

TABLE 5.—Natural, masonry (natural), and puzzolan (slag-lime) cements produced, shipped, and in stock at mills in the United States, 1945–49

Year	Production		Shipments		Stocks on Dec. 31
	Active plants	Barrels (376 pounds)	Barrels (376 pounds)	Value	Barrels (376 pounds)
1945	9	1,483,763	1,479,513	$2,093,848	170,324
1946	9	2,474,674	2,533,106	4,155,171	112,031
1947	9	2,951,098	2,927,885	5,764,398	145,408
1948	9	3,440,248	3,375,135	7,734,289	[1] 209,901
1949	9	3,185,229	3,233,525	8,006,361	161,605

[1] Revised figure.

TYPES OF CEMENT

A breakdown of the total production of portland cement by various types for the 1945–49 period is shown in the accompanying table. The output of five and shipments of four types of portland cement in 1949 increased over the quantities reported in 1948. Production of sulfate-resisting (type V), oil-well, and portland-puzzolan decreased, and shipments of low-heat (type IV), sulfate-resisting (type V), oil-well, and portland-puzzolan declined. The continued increase in the production of white and air-entrained cement is noteworthy.

Prepared Masonry Mortars.—Production of these mixed materials in 1949 was reported by 98 plants and amounted to 9,259,239 barrels. Shipments totaled 9,007,758 barrels valued at $24,921,761—an average

of $2.77 per barrel. These data are not included in the statistical tabulations in this chapter, but the portland cement used in manufacturing these mixtures is included.

TABLE 6.—Portland cement produced and shipped in the United States,[1] 1945–49, by types

Type and year	Active plants	Production (barrels)	Shipments		
			Barrels	Value	
				Total	Average
General use and moderate heat (types I and II):					
1945	145	89,922,894	93,379,480	$148,653,647	$1.59
1946	153	139,173,936	144,038,503	244,051,517	1.69
1947	150	157,525,464	158,637,287	297,619,024	1.88
1948	150	174,909,904	173,365,414	374,584,386	2.16
1949	150	177,597,585	174,569,746	396,817,234	2.27
High-early-strength (type III):					
1945	[2] 98	5,487,460	5,602,875	11,280,392	2.01
1946	[2] 105	6,716,488	7,183,209	14,977,117	2.09
1947	[2] 87	6,015,985	5,899,830	13,284,390	2.25
1948	[2] 87	5,513,312	5,615,894	14,224,177	2.53
1949	87	5,979,435	5,649,482	15,047,036	2.66
Low-heat (type IV):					
1945	3	35,715	30,840	50,358	1.63
1946	3	139,996	136,541	248,057	1.82
1947	5	125,113	137,469	252,721	1.84
1948	3	135,871	153,994	306,962	1.99
1949	6	159,739	129,411	329,284	2.54
Sulfate-resisting (type V):					
1945	4	5,141	3,915	7,952	2.03
1946	4	65,880	60,950	125,204	2.05
1947	5	64,126	94,455	231,523	2.45
1948	6	204,862	163,127	505,710	3.10
1949	5	95,023	113,370	472,016	4.16
Oil-well:					
1945	16	1,231,756	1,305,493	2,499,739	1.91
1946	17	1,510,843	1,568,881	3,110,351	1.98
1947	18	1,701,305	1,708,719	3,592,577	2.10
1948	14	1,817,746	1,966,854	4,972,499	2.53
1949	17	1,714,938	1,745,908	4,554,603	2.61
White:					
1945	5	425,299	456,210	1,859,070	4.08
1946	5	774,215	797,194	3,299,200	4.14
1947	4	855,323	837,489	3,762,417	4.49
1948	4	1,034,500	1,005,356	4,510,169	4.49
1949	4	1,071,100	1,031,408	4,985,107	4.83
Portland-puzzolan:					
1945	3	212,156	250,944	389,483	1.55
1946	5	1,092,607	1,091,854	1,696,870	1.55
1947	5	1,519,961	1,529,551	2,970,919	1.94
1948	6	1,545,584	1,693,207	3,733,436	2.20
1949	4	1,080,848	1,147,694	2,602,853	2.27
Air-entrained:					
1945	52	5,075,332	4,903,355	7,773,719	1.59
1946	69	13,765,384	13,850,983	23,173,284	1.67
1947	73	17,850,165	17,768,010	32,359,835	1.82
1948	73	19,421,610	19,453,359	40,322,716	2.07
1949	78	21,266,590	20,940,562	46,091,687	2.20
Miscellaneous:[3]					
1945	11	409,131	420,483	822,651	1.96
1946	21	824,839	839,478	1,714,743	2.04
1947	20	861,905	879,059	2,140,570	2.44
1948	20	864,874	887,457	2,518,018	2.84
1949	24	762,159	752,744	2,277,212	3.03
Grand total:					
1945	145	102,804,884	106,353,595	173,337,010	1.63
1946	153	164,064,188	169,567,593	292,396,343	1.72
1947	150	186,519,347	187,491,869	356,213,976	1.90
1948	150	205,448,263	204,304,662	445,678,073	2.18
1949	150	209,727,417	206,080,325	473,177,032	2.30

[1] Including Puerto Rico and Hawaii.
[2] Revised figure.
[3] Includes hydroplastic, plastic, and waterproofed cements.

CAPACITY OF PLANTS

The total estimated annual capacity of all portland-cement plants in 1949, as reported to the Bureau of Mines by producers, increased 2 percent over that reported in 1948.

The overall rate of operation in 1949 was at 81 percent of the total capacity—the same rate as in 1948. As indicated in the following table, the percentage of capacity utilized gained in 10 and decreased in 8 districts. There was no change in one district. In the continental United States the increases in percentage points ranged from 2 (in 4 districts) to 16 in the Virginia-Georgia-Florida-Louisiana-South Carolina district. A decrease of 36 points was recorded in the Puerto Rican district. The percentage of capacity utilized in each month of 1949 was slightly higher for the first 4 months than in 1948, but beginning in June the industry operated at a lower level. As in 1948, the peak was reached in September, with a decline at year end.

TABLE 7.—Portland-cement-manufacturing capacity of the United States, 1948–49, by districts

District	Estimated capacity (barrels)		Percent of capacity utilized	
	1948	1949	1948	1949
Eastern Pennsylvania, Maryland	38,943,325	38,403,325	86.3	88.0
New York, Maine	17,561,640	17,398,048	76.9	79.5
Ohio	12,952,515	12,952,515	77.5	79.6
Western Pennsylvania, West Virginia	13,961,300	14,961,300	64.0	59.7
Michigan	14,200,000	15,394,776	80.4	82.9
Illinois	9,864,510	9,524,510	76.7	85.3
Indiana, Kentucky, Wisconsin	17,989,163	17,824,000	68.6	71.2
Alabama	11,177,660	10,967,660	88.6	88.6
Tennessee	7,357,000	7,322,000	91.4	83.0
Virginia, Georgia, Florida, Louisiana, South Carolina	9,980,000	9,740,000	71.5	87.3
Iowa	8,430,000	7,830,000	80.7	87.3
Eastern Missouri, Minnesota, South Dakota	11,387,265	11,387,265	84.8	86.7
Kansas	9,497,000	9,407,000	83.5	83.2
Western Missouri, Nebraska, Oklahoma, Arkansas	7,850,000	8,600,000	88.7	86.2
Texas	16,006,000	16,596,000	85.6	90.1
Colorado, Arizona,[1] Wyoming, Montana, Utah, Idaho	7,625,000	9,010,000	71.6	69.5
California	29,170,000	29,870,000	84.3	77.7
Oregon, Washington	7,780,000	8,130,000	86.6	78.7
Puerto Rico	2,540,000	3,630,000	96.1	60.4
Total	254,272,378	258,948,399	80.8	81.0

[1] Arizona began operating in December 1949.

TABLE 8.—Percentage of capacity used in the finished portland-cement industry in the United States, 1948–49

Month	Monthly		12 months ended—		Month	Monthly		12 months ended—	
	1948	1949	1948	1949		1948	1949	1948	1949
January	71	73	78	84	July	90	87	81	83
February	70	73	79	84	August	91	87	82	83
March	71	74	79	85	September	93	92	83	83
April	80	85	78	82	October	93	88	83	83
May	86	86	80	83	November	92	86	84	83
June	89	87	80	83	December	84	78	84	82

The total capacity of wet-process plants, as indicated in the accompanying table, continued to increase. Dry-process plants, whose capacity declined slightly in 1948, increased to virtually the same figure as in 1947. The percentage of cement produced by wet-process plants in 1949 increased slightly over that for 1948 and declined for dry-process operations.

TABLE 9.—Capacity of portland-cement plants in the United States,[1] 1947–49, by processes

Process	Capacity						Percent of capacity utilized			Percent of total finished cement produced		
	Thousands of barrels			Percent of total								
	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949
Wet	129,116	136,588	139,169	51.8	53.7	53.7	78.0	81.4	83.7	54.0	54.1	55.6
Dry	119,991	117,684	119,779	48.2	46.3	46.3	71.5	80.1	77.8	46.0	45.9	44.4
Total	249,107	254,272	258,948	100.0	100.0	100.0	74.9	80.8	81.0	100.0	100.0	100.0

[1] Includes Puerto Rico and Hawaii.

A grouping of the cement plants based on their annual capacity is shown in the following table. Substantial gains were recorded in the 2,000,000- to 3,000,000-barrel-capacity group, whereas the number of plants in the 1,000,000- to 2,000,000-barrel-capacity group declined. There were no changes in two remaining groups.

Number of portland-cement plants in the United States (including Puerto Rico) by size groups, in 1949

Estimated annual capacity, barrels:	*Number of plants*
Less than 1,000,000	26
1,000,000 to 2,000,000	87
2,000,000 to 3,000,000	28
3,000,000 to 10,000,000	11
Total	152

CLINKER PRODUCTION

The output of clinker, the intermediate product between raw materials and the finished cement, was 2 percent greater in 1949 than in 1948. Peak production was reached in May, while stocks reached their greatest accumulation in March. Stocks of clinker on December 31, 1949, were 21 percent greater than those reported for the year-end 1948.

TABLE 10.—Production and stocks of portland-cement clinker at mills in the United States in 1949, by months and districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania, Maryland	2,837	2,521	2,738	2,847	2,985	2,894	2,776	3,013	2,882	2,972	2,833	2,815
New York, Maine	1,040	888	1,013	952	1,085	1,117	1,248	1,214	1,282	1,320	1,227	1,208
Ohio	867	575	798	945	950	925	912	956	962	899	839	840
Western Pennsylvania, West Virginia	690	734	781	779	760	702	719	670	695	781	760	678
Michigan	984	792	774	1,110	1,186	1,165	1,194	1,228	1,189	1,274	1,184	1,172
Illinois	684	628	684	678	695	658	661	719	716	754	738	700
Indiana, Kentucky, Wisconsin	1,010	971	1,068	1,114	1,168	1,145	1,139	1,224	1,239	976	856	1,129
Alabama	840	771	874	884	890	809	782	821	794	832	798	808
Tennessee	582	515	477	528	586	499	493	555	438	483	530	570
Virginia, Georgia, Florida, Louisiana, South Carolina	754	619	700	710	717	745	755	731	736	767	702	742
Iowa	549	466	443	494	615	563	616	589	594	684	651	668
Eastern Missouri, Minnesota, South Dakota	779	714	828	841	874	829	813	784	831	739	793	888
Kansas	542	536	660	647	709	684	678	692	694	714	696	708
Western Missouri, Nebraska, Oklahoma, Arkansas	598	527	528	590	660	636	677	541	622	706	665	642
Texas	1,145	1,126	1,177	1,238	1,239	1,250	1,358	1,358	1,331	1,242	1,271	1,383
Colorado, Arizona,[1] Wyoming, Montana, Utah, Idaho	494	441	543	529	538	489	560	496	418	635	601	641
California	1,953	1,779	1,804	1,781	2,089	2,059	2,068	2,117	1,982	1,978	1,999	2,047
Oregon, Washington	442	353	505	589	666	566	572	556	568	596	496	492
Puerto Rico	214	177	215	186	197	182	209	98	27	197	215	191
United States: 1949	17,004	15,133	16,600	17,442	18,609	17,917	18,230	18,362	18,000	18,240	17,854	18,320
1948	15,455	14,444	15,439	16,050	17,617	17,336	18,347	18,487	17,961	19,315	18,470	18,624
STOCKS (END OF MONTH)												
Eastern Pennsylvania, Maryland	758	856	918	938	1,009	1,110	950	896	769	583	534	627
New York, Maine	886	437	550	553	580	511	430	832	221	204	218	295
Ohio	298	302	347	363	304	295	318	292	240	189	195	194
Western Pennsylvania, West Virginia	185	241	803	374	442	429	464	417	307	167	149	195
Michigan	541	873	1,291	1,232	968	688	437	460	240	88	88	287
Illinois	44	107	207	173	132	123	91	98	49	16	31	95
Indiana, Kentucky, Wisconsin	647	592	725	670	613	529	462	446	352	301	157	312
Alabama	95	117	152	176	205	253	254	254	230	223	147	153
Tennessee	91	187	179	235	277	278	237	252	245	141	112	128
Virginia, Georgia, Florida, Louisiana, South Carolina	107	83	113	88	73	86	53	48	32	56	40	64
Iowa	171	216	226	216	266	200	200	149	80	72	157	255
Eastern Missouri, Minnesota, South Dakota	825	350	346	369	380	371	317	218	163	89	108	171
Kansas	109	115	149	148	92	91	100	98	87	30	22	93
Western Missouri, Nebraska, Oklahoma, Arkansas	69	135	169	124	114	168	165	165	113	109	75	87
Texas	103	132	152	120	121	78	147	156	163	85	75	97
Colorado, Arizona,[1] Wyoming, Montana, Utah, Idaho	290	448	483	523	558	512	418	338	139	107	147	232
California	863	1,030	997	860	889	862	893	894	827	887	848	928
Oregon, Washington	355	497	418	364	385	323	245	254	182	221	236	322
Puerto Rico	38	34	39	34	26	15	25	22	22	42	48	42
United States: 1949	5,475	6,752	7,764	7,560	7,440	6,922	6,212	5,798	4,461	3,610	3,387	4,577
1948	4,299	5,196	6,072	5,930	5,650	5,032	4,514	3,916	3,068	2,824	2,781	[2] 3,781

[1] Arizona first started operating in December 1949. [2] Revised figure.

TABLE 11.—Portland-cement clinker produced and in stock at mills in the United States,[1] 1948–49, by processes, in barrels of 376 pounds[2]

Process	Plants		Production		Stocks on Dec. 31—	
	1948	1949	1948	1949	1948[3]	1949[4]
Wet	88	88	112,034,399	117,106,285	1,663,143	2,212,524
Dry	60	62	95,509,673	94,613,974	2,118,107	2,364,688
Total	148	150	207,544,072	211,720,259	3,781,250	4,577,212

[1] Including Puerto Rico.
[2] Compiled from monthly estimates of producers.
[3] Revised figures.
[4] Preliminary figures.

RAW MATERIALS

"Limestone and clay or shale" have been the predominant constituents in portland cement for the past 40 years. In 1949, 72 percent of the output was made from this combination compared with 71 percent in 1948. "Cement rock and pure limestone" furnished 22 percent in 1949, whereas the combination of "blast-furnace slag and limestone" supplied 5 percent of the output. As in the past years, "marl and clay" supplied a minor part of the raw materials utilized by the cement industry, accounting for 2 percent of the output.

TABLE 12.—Production and percentage of total output of portland cement in the United States,[1] 1901–14, 1926, 1929, 1933, 1935, and 1941–49, according to raw materials

Year	Cement rock and pure limestone		Limestone and clay or shale[2]		Marl and clay		Blast-furnace slag and limestone	
	Barrels	Percent	Barrels	Percent	Barrels	Percent	Barrels	Percent
1901	8,503,500	66.9	2,042,209	16.1	2,001,260	15.7	164,316	1.3
1902	10,953,178	63.6	3,738,303	21.7	2,220,453	12.9	318,710	1.8
1903	12,493,694	55.9	6,333,403	28.3	3,052,946	13.7	462,930	2.1
1904	15,173,391	57.2	7,526,323	28.4	3,332,873	12.6	473,294	1.8
1905	18,454,902	52.4	11,172,389	31.7	3,884,178	11.0	1,735,343	4.9
1906	23,896,951	51.4	16,532,212	35.6	3,958,201	8.5	2,076,000	4.5
1907	25,859,095	53.0	17,190,697	35.2	3,606,598	7.4	2,129,000	4.4
1908	20,678,693	40.6	23,047,707	45.0	2,811,212	5.5	4,535,300	8.9
1909	24,274,047	37.3	32,219,365	49.6	2,711,219	4.2	5,786,800	8.9
1910	26,520,911	34.6	39,720,320	51.9	3,307,220	4.3	7,001,500	9.2
1911	26,812,129	34.1	40,665,332	51.8	3,314,176	4.2	7,737,000	9.9
1912	24,712,780	30.0	44,607,776	54.1	2,467,368	3.0	10,686,173	12.9
1913	29,333,490	31.8	47,831,863	51.9	3,734,778	4.1	11,197,000	12.2
1914	24,907,047	28.2	50,168,813	56.9	4,038,310	4.6	9,116,000	10.3
1926	44,090,657	26.8	101,637,865	61.8	3,324,498	2.0	15,477,239	9.4
1929	51,077,034	29.9	97,623,502	57.2	4,832,700	2.9	17,112,800	10.0
1933	14,135,171	22.3	43,638,023	68.7	1,402,744	2.2	4,297,251	6.8
1935	23,811,687	31.0	45,073,144	58.8	1,478,569	1.9	6,378,170	8.3
1941	46,534,193	28.4	102,285,699	62.3	3,142,021	1.9	12,068,646	7.4
1942	49,479,304	27.0	115,948,373	63.4	3,009,562	1.7	14,343,945	7.9
1943	28,915,157	22.4	92,310,018	69.2	2,300,636	1.7	8,897,977	6.7
1944	17,608,065	19.4	65,478,178	72.0	2,078,530	2.3	5,739,933	6.3
1945	20,383,506	19.8	73,409,831	71.4	2,035,236	2.0	6,976,312	6.8
1946	39,070,643	23.8	112,142,154	68.3	2,720,500	1.7	10,130,891	6.2
1947	43,428,201	23.3	129,338,247	69.3	2,408,845	1.3	11,344,654	6.1
1948	47,559,783	23.1	144,855,487	70.5	2,620,060	1.3	10,412,933	5.1
1949	45,655,516	21.8	150,435,948	71.7	3,310,270	1.6	10,326,683	4.9

[1] Includes Puerto Rico and Hawaii, 1941–49.
[2] Includes output of 2 plants using oystershells and clay in 1926; 3 plants in 1929, 1933, and 1935; 4 plants in 1941–45; and 5 plants in 1946–49.

The tonnages of raw materials (exclusive of fuel and explosives) required for the production of portland cement in 1947–49 are given in the following table. Limestone, cement rock, and clay and shale constitute 94 percent of the total materials consumed in 1949. Except for cement rock and blast-furnace slag, all types of materials consumed during the year gained over 1948.

TABLE 13.—Raw materials used in producing portland cement in the United States,[1] 1947–49

Raw material	1947	1948	1949
	Short tons	*Short tons*	*Short tons*
Cement rock	11,728,062	13,046,856	12,628,494
Limestone (including oystershells)	40,034,322	43,489,837	44,968,739
Marl	563,148	601,716	722,606
Clay and shale [2]	5,373,591	6,440,584	6,698,408
Blast-furnace slag	864,617	896,474	847,375
Gypsum	1,445,622	1,507,876	1,543,198
Sand and sandstone (including silica and quartz)	821,017	723,769	724,624
Iron materials [3]	257,048	318,106	346,542
Miscellaneous [4]	147,056	133,716	140,999
Total	61,234,483	67,158,934	68,620,985
	Pounds	*Pounds*	*Pounds*
Average total weight required per barrel (376 pounds) of finished cement	657	654	654

[1] Including Puerto Rico and Hawaii.
[2] Includes bentonite, diatomaceous shale, and fuller's earth.
[3] Includes iron ore, pyrite cinders and ore, and mill scale.
[4] Includes diatomite, fluorspar, pumicite, flue dust, pitch, red mud and rock, hydrated lime, tufa, cinders, calcium chloride, sludge, grinding aids, and air-entraining compounds.

FUEL AND POWER

Of all the fuels used in the manufacture of portland cement (coal, fuel oil, natural gas, and byproduct gas), only natural gas showed an increase in the amount consumed during 1949. The percentage changes in consumption compared with 1948 are: Coal, 7-percent decrease; fuel oil, 2-percent decrease; natural gas, 17-percent increase; and byproduct gas, 86-percent decrease. Average monthly consumption of these fuels in 1949 compared to 1948 (1948 averages in parentheses) was: Coal, 665,630 (712,804) short tons; fuel oil, 382,217 (388,196) barrels; natural gas, 7,043,433 (6,011,568) thousand cubic feet; and byproduct gas, 14,007 (97,865) thousand cubic feet.

The number of plants using electric energy, the kilowatt-hours generated and purchased, and the average electric energy used per barrel of cement compared with 1948 figures are shown in an accompanying table. The percentage of electricity generated declined slightly, and the quantity purchased increased.

TABLE 14.—Finished portland cement produced and fuel consumed by the portland-cement industry in the United States,[1] 1948–49, by processes

Process	Finished cement produced			Fuel consumed [2]		
	Plants	Barrels of 376 pounds	Percent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (M cubic feet)
1948						
Wet	89	111,152,861	54.1	4,182,633	2,828,993	50,868,082
Dry	61	94,295,402	45.9	4,371,017	1,829,363	[3] 22,445,110
Total	150	205,448,263	100.0	[4] 8,553,650	4,658,356	[3] 73,313,192
1949						
Wet	88	116,522,681	55.6	3,830,313	3,203,950	61,783,635
Dry	62	93,204,736	44.4	4,157,247	1,382,648	[3] 22,905,649
Total	150	209,727,417	100.0	[5] 7,987,560	4,586,598	[3] 84,689,284

[1] Includes Puerto Rico.
[2] Figures compiled from monthly estimates of producers.
[3] Includes byproduct gas: 1948—1,174,377 M cubic feet; 1949—168,088 M cubic feet.
[4] Comprises 8,162 tons of anthracite and 8,545,488 tons of bituminous coal.
[5] Comprises 22,019 tons of anthracite and 7,965,541 tons of bituminous coal.

TABLE 15.—Portland cement produced in the United States,[1] 1948–49, by kind of fuel

Fuel	Finished cement produced			Fuel consumed [2]		
	Number of plants	Barrels of 376 pounds	Percent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (M cubic feet)
1948						
Coal	86	[3] 111,639,361	54.3	6,828,396		
Oil	11	[3] 16,134,873	7.9		3,228,053	
Natural gas	13	[3] 17,428,962	8.5			26,178,518
Coal and oil	10	16,404,113	8.0	910,801	546,288	
Coal and natural gas	14	16,952,731	8.2	574,555		[4] 14,057,923
Oil and natural gas	7	15,134,254	7.4		757,296	19,182,357
Coal, oil, and natural gas	9	11,753,969	5.7	239,898	126,719	13,894,394
Total	150	205,448,263	100.0	[5] 8,553,650	4,658,356	73,313,192
1949						
Coal	79	[3] 108,639,061	51.8	6,252,160		
Oil	11	[3] 12,317,399	5.9		2,475,865	
Natural gas	14	[3] 20,215,714	9.6			30,698,450
Coal and oil	13	19,920,475	9.5	1,093,047	888,571	
Coal and natural gas	16	19,192,617	9.2	497,829		[6] 19,667,208
Oil and natural gas	8	18,081,667	8.6		1,133,474	18,746,653
Coal, oil, and natural gas	9	11,360,484	5.4	144,524	88,688	15,576,973
Total	150	209,727,417	100.0	[7] 7,987,560	4,586,598	84,689,284

[1] Including Puerto Rico.
[2] Figures compiled from monthly estimates of producers.
[3] Average consumption of fuel per barrel of cement produced was as follows: 1948—Coal, 122.3 pounds; oil, 0.2001 barrel; natural gas, 1,502 cubic feet. 1949—Coal, 115.1 pounds; oil, 0.2010 barrel; natural gas, 1,519 cubic feet.
[4] Includes 1,174,377 M cubic feet of byproduct gas.
[5] Comprises 8,162 tons of anthracite and 8,545,488 tons of bituminous coal.
[6] Includes 168,088 M cubic feet of byproduct gas.
[7] Comprises 22,019 tons of anthracite and 7,965,541 tons of bituminous coal.

TABLE 16.—Electric energy used at portland-cement-producing plants in the United States,[1] 1948–49, by processes, in kilowatt-hours

Process	Electric energy used						Finished cement produced (barrels)	Average electric energy used per barrel of cement produced (kilowatt-hours)
	Generated at portland-cement plants		Purchased		Total			
	Active plants	Kilowatt-hours	Active plants	Kilowatt-hours	Kilowatt-hours	Percent		
1948								
Wet	33	768,380,279	80	1,654,086,208	2,422,466,487	53.1	111,152,861	21.8
Dry	32	1,212,270,475	51	923,903,358	2,136,173,833	46.9	94,295,402	22.7
Total	65	1,980,650,754	131	2,577,989,566	4,558,640,320	100.0	205,448,263	22.2
Percent of total electric energy used		43.4		56.6	100.0			
1949								
Wet	32	792,393,327	79	1,755,800,663	2,548,193,990	54.5	116,522,681	21.9
Dry	33	1,194,368,472	51	932,661,738	2,127,030,210	45.5	93,204,736	22.8
Total	65	1,986,761,799	130	2,688,462,401	4,675,224,200	100.0	209,727,417	22.3
Percent of total electric energy used		42.5		57.5	100.0			

[1] Including Puerto Rico.

EMPLOYMENT AND PRODUCTIVITY

Trends in employment and output per man in the cement industry in 1945–46 are shown in the tables following. Supplemental data for 1945–46 and corresponding data for earlier years were published in Minerals Yearbook, 1947, pp. 220–221.

TABLE 17.—Employment in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States,[1] 1945–46, by districts

District	Employment					Production			Percent of industry represented[2]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1945									
Eastern Pennsylvania and Maryland	3,213	260	835,619	8.1	6,760,771	14,511,861	17.37	2.15	100.0
New York and Maine	1,208	293	354,398	8.0	2,846,622	5,617,380	15.85	1.97	100.0
Ohio	1,018	284	289,566	8.2	2,387,456	4,604,294	15.90	1.93	100.0
Western Pennsylvania and West Virginia	1,109	305	338,611	8.1	2,733,289	3,100,859	9.16	1.13	100.0
Michigan	1,239	292	362,379	8.0	2,904,091	5,839,190	16.11	2.01	100.0
Illinois	762	277	211,389	8.2	1,729,947	4,366,928	20.66	2.52	100.0
Indiana, Kentucky, and Wisconsin	1,461	321	468,587	8.0	3,746,227	6,224,200	13.28	1.66	100.0
Alabama	911	277	252,065	7.8	1,971,429	5,541,591	21.98	2.81	100.0
Tennessee	721	257	185,398	8.0	1,483,183	2,881,505	15.54	1.94	100.0
Virginia, Georgia, Florida, and Louisiana	997	317	315,913	8.0	2,538,222	4,744,080	15.02	1.87	100.0
Iowa	1,091	255	277,788	8.0	2,225,578	3,194,164	11.50	1.44	100.0
Eastern Missouri, Minnesota, and South Dakota	1,132	225	254,900	7.6	1,946,380	3,860,978	15.15	1.98	100.0
Kansas	693	257	178,048	8.1	1,449,047	3,000,731	16.85	2.07	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	752	309	232,469	7.7	1,788,242	3,469,932	14.93	1.94	100.0
Texas	1,147	322	369,017	8.0	2,969,824	8,036,515	21.78	2.71	100.0
Colorado, Wyoming, Montana, Utah, and Idaho	586	296	173,129	8.0	1,387,294	3,021,587	17.45	2.18	100.0
California	1,875	341	639,178	8.0	5,138,541	15,951,762	24.96	3.10	100.0
Oregon and Washington	780	255	199,226	8.1	1,606,776	3,372,943	16.93	2.10	100.0
Total	20,695	287	5,937,680	8.0	47,612,919	101,340,500	17.07	2.13	98.6
1946									
Eastern Pennsylvania and Maryland	4,318	304	1,313,830	8.0	10,532,303	26,489,149	20.16	2.52	100.0
New York and Maine	1,944	293	568,795	7.8	4,430,762	11,411,868	20.06	2.58	100.0
Ohio	1,295	321	415,835	8.0	3,327,875	8,034,762	19.32	2.41	100.0
Western Pennsylvania and West Virginia	1,390	292	406,546	8.0	3,241,619	6,741,134	16.58	2.08	100.0
Michigan	1,366	319	435,431	8.0	3,487,947	9,693,767	22.26	2.78	100.0
Illinois	1,024	324	331,595	8.0	2,653,424	6,270,252	18.91	2.36	100.0
Indiana, Kentucky, and Wisconsin	1,824	342	623,780	8.0	4,995,854	10,571,385	16.95	2.12	100.0
Alabama	1,006	299	300,596	8.0	2,416,172	7,897,157	26.27	3.27	100.0
Tennessee	855	289	247,455	7.9	1,963,356	5,218,370	21.09	2.66	100.0
Virginia, Georgia, Florida, and Louisiana	1,112	327	363,277	7.5	2,714,582	5,656,967	15.57	2.08	100.0
Iowa	1,014	318	322,546	8.0	2,572,493	5,513,079	17.09	2.14	100.0
Eastern Missouri, Minnesota, and South Dakota	1,378	302	415,950	8.0	3,328,155	7,641,752	18.37	2.30	100.0
Kansas	956	300	287,197	7.9	2,265,545	6,404,648	22.30	2.83	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	808	345	278,928	7.8	2,164,845	5,703,483	20.45	2.63	100.0
Texas	1,319	326	430,158	8.2	3,520,052	10,712,538	24.90	3.04	100.0
Colorado, Wyoming, Montana, Utah, and Idaho	601	334	200,903	7.9	1,596,538	4,088,203	20.34	2.56	100.0
California	2,029	330	669,258	8.0	5,370,974	19,540,796	29.20	3.64	100.0
Oregon and Washington	805	279	224,648	8.0	1,808,783	4,706,979	20.95	2.60	100.0
Total	25,044	313	7,836,318	8.0	62,384,279	162,296,274	20.71	2.60	98.9

[1] Exclusive of Puerto Rico and Hawaii.
[2] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

TABLE 18.—Mill employees in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States,[1] 1945–46, by districts

District	Employment—cement mills only					Production			Percent of industry represented[2]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1945									
Eastern Pennsylvania and Maryland	2,512	274	687,151	8.1	5,570,324	14,511,861	21.12	2.61	100.0
New York and Maine	917	305	279,904	8.0	2,251,436	5,617,380	20.07	2.49	100.0
Ohio	818	292	239,175	8.2	1,957,248	4,604,294	19.25	2.35	100.0
Western Pennsylvania and West Virginia	640	309	197,948	8.1	1,603,508	3,100,859	15.67	1.93	100.0
Michigan	1,086	295	320,569	8.0	2,564,548	5,839,190	18.22	2.28	100.0
Illinois	648	283	183,673	8.2	1,505,773	4,366,928	23.78	2.90	100.0
Indiana, Kentucky, and Wisconsin	1,275	327	416,408	8.0	3,319,289	6,224,200	14.95	1.88	100.0
Alabama	603	341	205,869	7.7	1,589,871	5,541,591	26.92	3.49	100.0
Tennessee	512	266	136,126	8.0	1,089,006	2,881,505	21.17	2.65	100.0
Virginia, Georgia, Florida, and Louisiana	743	336	249,911	8.0	1,995,036	4,744,080	18.98	2.38	100.0
Iowa	926	267	246,988	8.0	1,979,726	3,194,164	12.93	1.61	100.0
Eastern Missouri, Minnesota, and South Dakota	948	238	225,835	7.6	1,718,078	3,860,978	17.10	2.25	100.0
Kansas	469	254	119,003	8.0	954,156	3,000,731	25.22	3.14	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	603	318	191,850	7.6	1,455,466	3,469,932	18.09	2.38	100.0
Texas	993	329	326,525	8.0	2,622,394	8,036,515	24.61	3.06	100.0
Colorado, Wyoming, Montana, Utah, and Idaho	422	307	129,736	8.0	1,037,892	3,021,587	23.29	2.91	100.0
California	1,468	352	516,167	8.0	4,154,435	15,951,762	30.90	3.84	100.0
Oregon and Washington	559	265	147,897	8.0	1,183,177	3,372,943	22.81	2.85	100.0
Total	16,142	299	4,820,735	8.0	38,551,413	101,340,500	21.02	2.63	98.6
1946									
Eastern Pennsylvania and Maryland	2,874	317	910,500	8.0	7,294,081	26,489,149	29.09	3.63	100.0
New York and Maine	1,313	304	399,686	7.7	3,079,076	11,411,868	28.55	3.71	100.0
Ohio	926	330	305,421	8.0	2,443,439	8,034,762	26.31	3.29	100.0
Western Pennsylvania and West Virginia	869	302	262,822	7.9	2,088,913	6,741,134	25.65	3.23	100.0
Michigan	1,256	322	404,394	8.0	3,235,484	9,693,767	23.97	3.00	100.0
Illinois	757	333	251,989	8.0	2,016,436	6,270,252	24.88	3.11	100.0
Indiana, Kentucky, and Wisconsin	1,581	350	552,652	8.0	4,421,316	10,571,385	19.13	2.39	100.0
Alabama	665	314	208,894	8.0	1,676,755	7,897,157	37.80	4.71	100.0
Tennessee	534	295	157,538	7.9	1,240,889	5,218,370	33.12	4.21	100.0
Virginia, Georgia, Florida, and Louisiana	832	336	279,549	7.4	2,057,179	5,656,967	20.24	2.75	100.0
Iowa	791	333	263,232	8.0	2,096,074	5,513,070	20.94	2.63	100.0
Eastern Missouri, Minnesota, and South Dakota	867	319	276,831	8.0	2,214,583	7,641,752	27.60	3.45	100.0
Kansas	709	310	219,998	7.8	1,709,223	6,404,648	29.11	3.75	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	658	355	233,890	7.7	1,794,728	5,703,483	24.39	3.18	100.0
Texas	1,009	334	337,116	8.2	2,766,076	10,712,538	31.78	3.87	100.0
Colorado, Wyoming, Montana, Utah, and Idaho	446	342	152,407	7.9	1,204,728	4,088,203	26.82	3.39	100.0
California	1,466	341	500,444	8.0	4,011,548	19,540,790	39.05	4.87	100.0
Oregon and Washington	545	289	157,438	8.0	1,260,307	4,706,979	29.90	3.73	100.0
Total	18,101	325	5,874,301	7.9	46,610,834	162,296,274	27.63	3.48	98.9

[1] Exclusive of Puerto Rico and Hawaii.

[2] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

TABLE 19.—Quarry and crusher employees in the portland-cement industry, material (quarry rock) handled at quarries included in study, and average output of material per man in the United States,[1] 1945–46, by districts

District	Employment—quarry and crusher only					Material handled—quarry rock			Percent of industry represented[2]
	Average number of men	Time employed				Short tons	Average per man (short tons)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1945									
Eastern Pennsylvania and Maryland	542	216	117,318	8.0	941,252	4,349,610	37.08	4.62	97.5
New York and Maine	186	233	43,409	8.0	346,459	1,461,177	33.66	4.22	100.0
Ohio	190	256	48,641	8.6	416,210	1,314,726	27.03	3.16	100.0
Western Pennsylvania and West Virginia	310	282	87,277	8.1	702,693	1,319,926	15.12	1.88	55.1
Michigan	73	261	19,074	8.0	152,554	544,737	28.56	3.57	54.1
Illinois	112	244	27,284	8.1	220,715	1,348,080	49.41	6.11	100.0
Indiana, Kentucky, and Wisconsin	178	279	49,667	8.2	406,841	868,257	17.48	2.13	56.9
Alabama	180	249	44,844	8.3	370,733	1,775,907	39.60	4.79	100.0
Tennessee	184	227	41,790	8.0	334,321	950,552	22.75	2.84	100.0
Virginia, Georgia, Florida, and Louisiana	211	249	52,476	8.3	434,845	1,569,566	29.91	3.61	100.0
Iowa	141	188	26,510	8.0	211,532	1,277,952	48.21	6.04	100.0
Eastern Missouri, Minnesota, and South Dakota	184	158	29,065	7.9	228,302	1,080,537	37.18	4.73	79.7
Kansas	138	210	28,993	8.0	231,300	985,460	33.99	4.26	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	145	272	39,375	8.2	323,716	1,132,698	28.77	3.50	100.0
Texas	115	276	31,771	8.3	262,534	1,842,022	57.98	7.02	93.4
Colorado, Wyoming, Montana, Utah, and Idaho	93	235	21,812	8.1	176,754	880,113	40.35	4.98	100.0
California	340	303	103,125	8.0	825,015	5,367,024	52.04	6.51	97.0
Oregon and Washington	178	251	44,686	8.3	369,105	1,054,371	23.60	2.86	87.1
Total	3,500	245	857,117	8.1	6,954,881	29,122,715	33.98	4.19	90.8
1946									
Eastern Pennsylvania and Maryland	744	258	191,784	8.0	1,542,354	8,122,189	42.35	5.27	94.9
New York and Maine	308	242	74,687	8.1	603,077	2,822,636	37.79	4.68	100.0
Ohio	266	284	75,612	8.0	605,726	2,232,602	29.53	3.69	100.0
Western Pennsylvania and West Virginia	346	270	93,454	8.0	748,122	3,058,103	32.72	4.09	68.5
Michigan	75	262	19,665	8.2	161,491	1,155,535	58.76	7.16	63.4
Illinois	131	291	38,105	8.0	304,871	1,798,314	47.19	5.90	100.0
Indiana, Kentucky, and Wisconsin	226	286	64,501	8.1	522,244	1,344,155	20.81	2.57	59.0
Alabama	219	265	58,052	7.9	461,381	2,461,262	42.40	5.33	97.9
Tennessee	212	254	53,908	8.1	435,338	1,544,069	28.64	3.55	100.0
Virginia, Georgia, Florida, and Louisiana	231	290	67,041	7.7	516,776	1,878,448	28.02	3.63	100.0
Iowa	169	244	41,235	8.0	331,790	1,684,233	40.84	5.08	100.0
Eastern Missouri, Minnesota, and South Dakota	210	280	58,742	8.0	470,971	1,932,744	32.90	4.10	85.0
Kansas	192	265	50,818	8.0	406,532	1,896,022	37.31	4.66	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	136	295	40,143	8.2	330,207	1,876,761	46.75	5.68	100.0
Texas	143	281	40,173	8.1	327,388	2,476,466	61.65	7.56	94.1
Colorado, Wyoming, Montana, Utah, and Idaho	93	308	28,598	8.1	231,526	1,320,220	46.16	5.70	99.7
California	415	295	122,533	8.1	989,175	6,225,678	50.81	6.29	95.8
Oregon and Washington	191	248	47,396	8.1	381,952	1,235,934	26.08	3.24	88.3
Total	4,307	271	1,166,537	8.0	9,370,921	45,065,371	38.63	4.81	90.9

[1] Exclusive of Puerto Rico and Hawaii.
[2] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

TRANSPORTATION

The quantity and proportion of cement shipped by each of the major methods of transportation for 1947–49 are listed in an accompanying table. The proportions shipped by truck in 1949 increased somewhat, whereas rail shipments declined, and the percentage carried by boat remained virtually the same.

TABLE 20.—Shipments of portland cement from mills in the United States,[1] 1947–49, in bulk and in containers, by types of carriers

[Barrels of 376 pounds]

Type of carrier	In bulk		In containers				Total shipments	
	Barrels	Percent	Bags: Paper (barrels)	Bags: Cloth (barrels)	Other containers[2] (barrels)	Total (barrels)	Barrels	Percent
1947								
Truck	[3]13,343,705	19.3	14,635,937	2,006,759	-------	16,642,696	29,986,401	16.0
Railroad	54,198,948	78.5	82,457,113	17,044,651	13,617	99.515,381	153,714,329	82.0
Boat	1,525,322	2.2	2,139.597	126,220	-------	2,265,817	3,791,139	2.0
Total	69,067,975	100.0	99,232,647	19,177,630	13,617	118,423,894	187,491,869	100.0
Percent of total	36.8	-----	53.0	10.2	([4])	63.2	100.0	-----
1948								
Truck	[3]18,526,570	21.7	16,242,337	1,329,250	-------	17,571,587	34,538,532	16.9
Railroad	65,210,300	76.6	82,889,312	16,513,115	15,850	99,418,277	166,188,202	81.3
Boat	1,440,323	1.7	2,103,000	34,605	-------	2,137,605	3,577,928	1.8
Total	85,177,193	100.0	101,234,649	17,876,970	15,850	119,127,469	204,304,662	100.0
Percent of total	41.7	-----	49.5	8.8	([4])	58.3	100.0	-----
1949								
Truck	[3]24,347,015	23.9	16,035,282	1,445,980	-------	17,481,262	42,476,387	20.6
Railroad	75,382,590	74.0	72,671,678	13,042,686	9,335	85,723,699	160,463,954	77.9
Boat	2,171,648	2.1	941,863	32,123	125	974,111	3,139,984	1.5
Total	101,901,253	100.0	89,648,823	14,520,789	9,460	104,179,072	206,080,325	100.0
Percent of total	49.5	-----	43.5	7.0	([4])	50.5	100.0	-----

[1] Includes Puerto Rico.
[2] Includes steel drums and iron and wood barrels.
[3] Includes cement used at mills by producers as follows—1947: 813,830 barrels; 1948: 646,420 barrels; 1949: 643,174 barrels.
[4] Less than 0.05 percent.

CONSUMPTION

The following tabulation shows that the indicated consumption of portland cement in 1949 increased in 30 States and the District of Columbia. Variation of percentages for the various States compared with 1948 ranges from a decrease of 29 for Arizona to an increase of 49 for Delaware. California, New York, Texas, Pennsylvania, Illinois, Ohio, and Michigan in that order were the largest consumers of cement in 1949. These 7 States accounted for 45 percent of the total consumption, while the 14 non-cement-producing States, including the District of Columbia, accounted for 12 percent of the total consumption.

TABLE 21.—Destination of shipments of finished portland cement from mills in the United States, 1947–49, by States

Destination	1947 (barrels)	1948 (barrels)	1949	
			Barrels	Change from 1948, percent
Continental:				
Alabama	2,930,108	3,178,143	2,910,444	−8.4
Arizona [1] [2]	1,491,197	1,766,820	1,262,378	−28.6
Arkansas	1,349,460	1,729,254	2,058,505	+19.0
California	19,301,504	20,567,994	19,943,561	−3.0
Colorado	1,837,330	1,972,316	2,041,456	+3.5
Connecticut [1]	2,156,811	2,364,453	2,381,551	+.7
Delaware [1]	431,850	502,794	746,858	+48.5
District of Columbia [1]	1,130,816	1,191,379	1,345,897	+13.0
Florida	4,221,661	4,493,013	4,487,460	−.1
Georgia	3,051,785	3,100,808	2,848,784	−8.1
Idaho	838,121	870,172	1,041,074	+19.6
Illinois	9,331,506	10,580,915	11,385,563	+7.6
Indiana	5,216,917	5,596,464	5,578,176	−.3
Iowa	4,262,177	4,272,285	4,844,659	+13.4
Kansas	3,724,882	4,213,812	4,137,843	−1.8
Kentucky	2,903,057	2,780,706	2,402,306	−13.6
Louisiana	3,134,441	3,820,931	3,986,777	+4.3
Maine	787,507	843,560	638,383	−24.3
Maryland	3,145,913	3,470,828	3,498,499	+.8
Massachusetts [1]	2,941,870	3,328,225	3,542,911	+6.5
Michigan	8,048,093	8,942,493	9,291,483	+3.9
Minnesota	3,914,258	4,195,552	4,441,401	+5.9
Mississippi [1]	1,537,801	1,746,788	1,787,000	+2.3
Missouri	4,893,203	5,299,347	4,541,405	−14.3
Montana	556,765	674,642	782,781	+16.0
Nebraska	1,817,942	2,094,185	2,537,791	+21.2
Nevada [1]	268,823	262,543	249,342	−5.0
New Hampshire [1]	519,317	505,735	542,685	+7.3
New Jersey [1]	5,272,019	6,103,555	6,109,668	+.1
New Mexico [1]	1,108,513	1,204,872	1,291,189	+7.2
New York	12,730,701	14,272,508	16,353,001	+14.6
North Carolina [1]	3,179,599	3,434,257	3,048,417	−11.2
North Dakota [1]	753,385	901,701	725,855	−19.5
Ohio	9,684,692	10,249,103	10,057,975	−1.9
Oklahoma	3,295,015	3,830,317	3,884,555	+1.4
Oregon	1,835,962	2,159,785	2,559,215	+18.5
Pennsylvania	10,974,095	12,480,244	12,738,153	+2.1
Rhode Island [1]	546,547	739,570	728,808	−1.5
South Carolina [3]	1,336,828	1,429,335	1,488,318	+4.1
South Dakota	924,729	1,050,780	1,093,465	+4.1
Tennessee	4,102,443	4,081,837	4,139,920	+1.4
Texas	11,520,189	12,893,560	13,183,797	+2.3
Utah	954,883	1,039,132	1,155,920	+11.2
Vermont [1]	497,077	458,626	445,759	−2.8
Virginia	3,571,849	3,550,455	3,832,190	+7.9
Washington	3,512,855	4,096,601	4,031,244	−1.6
West Virginia	2,400,206	2,155,276	2,803,256	+30.1
Wisconsin	4,585,162	5,060,929	4,540,926	−10.3
Wyoming	397,814	599,926	779,372	+29.9
Unspecified	333,666	35,141	52	−99.9
Total continental United States	179,253,344	196,193,667	200,248,023	+2.1
Outside continental United States [4]	8,238,525	8,110,995	5,832,302	−28.1
Total shipped from cement plants	187,491,869	204,304,662	206,080,325	+.9

[1] Non-cement-producing State.
[2] Included with cement-producing States in December 1949.
[3] South Carolina was a non-cement-producing State in 1947 and 1948 only.
[4] Direct shipments by producers to foreign countries and to noncontiguous Territories (Alaska, Hawaii, Puerto Rico, etc.), including distribution from Puerto Rican mills.

TABLE 22.—Destination of shipments of finished portland cement from mills in the United States in 1949, by months, in barrels

Destination	January	February	March	April	May	June	July	August	September	October	November	December
Alabama	205,660	197,075	232,710	247,062	265,633	245,363	249,735	304,008	256,454	265,813	248,814	191,267
Arizona	86,260	111,944	117,383	120,115	117,373	115,593	89,938	120,656	97,820	101,206	99,151	83,910
Arkansas	97,038	117,601	196,881	207,382	162,926	192,065	175,196	214,130	149,282	177,656	186,162	172,659
California	1,275,168	1,348,585	1,555,709	1,798,140	1,723,164	1,791,692	1,610,394	1,998,302	1,759,548	1,744,619	1,744,748	1,602,733
Colorado	46,840	92,093	157,664	148,714	155,820	214,848	199,097	225,069	233,001	227,611	208,261	131,980
Connecticut	98,007	97,134	147,285	195,645	208,048	254,214	250,910	276,100	302,590	246,003	103,735	111,157
Delaware	26,010	23,792	38,679	50,016	61,572	70,723	59,418	106,774	71,921	84,400	86,954	63,481
District of Columbia	94,080	89,543	91,494	105,019	117,950	79,791	109,783	136,690	118,930	152,476	135,711	116,639
Florida	331,849	341,245	365,578	360,075	369,505	348,604	357,369	381,392	367,056	440,766	423,630	308,295
Georgia	204,474	199,348	245,132	221,621	237,306	231,518	232,055	282,281	253,039	268,259	266,104	186,777
Idaho	40,925	21,452	106,636	114,754	118,010	111,225	94,805	103,349	103,977	91,884	85,426	47,789
Illinois	357,697	847,658	717,202	997,090	1,117,376	1,167,194	1,046,807	1,437,607	1,618,764	1,269,221	855,543	464,003
Indiana	163,517	189,875	402,408	520,877	527,656	552,242	638,549	766,370	682,903	564,743	410,821	243,393
Iowa	58,855	98,826	301,443	427,603	464,110	543,798	461,903	727,420	822,282	565,493	282,021	101,464
Kansas	88,457	92,336	248,093	417,351	416,092	381,356	387,309	517,732	418,683	536,965	464,283	181,463
Kentucky	57,411	105,598	198,541	239,794	242,847	218,419	229,794	235,829	257,780	258,289	223,240	119,257
Louisiana	317,611	225,106	297,209	284,256	385,909	374,594	310,616	396,856	378,442	359,556	369,692	281,751
Maine	14,808	12,115	20,105	49,822	61,659	88,131	71,464	96,656	87,196	71,015	45,552	19,985
Maryland	163,680	162,679	269,836	344,031	319,445	337,933	299,031	357,411	353,285	342,332	332,358	215,459
Massachusetts	179,660	170,308	245,090	306,480	312,092	351,772	312,705	349,113	380,665	378,322	322,505	233,218
Michigan	231,211	226,538	405,449	696,772	939,792	1,046,954	1,064,881	1,270,638	1,239,290	1,085,931	750,424	331,374
Minnesota	100,789	139,509	334,540	398,440	551,367	530,127	394,588	530,464	632,591	473,819	249,546	104,618
Mississippi	93,984	78,137	108,581	121,713	176,037	159,758	171,942	246,671	194,112	157,635	170,865	109,061
Missouri	103,206	161,003	208,997	394,517	438,665	420,878	392,700	547,905	542,321	558,740	439,722	239,356
Montana	9,039	17,257	42,715	86,507	85,640	97,195	82,218	84,216	91,825	90,657	72,185	22,868
Nebraska	23,251	43,867	95,371	194,150	280,629	246,088	316,087	360,891	340,567	372,894	202,518	60,729
Nevada	4,719	7,584	23,884	28,243	22,739	20,386	23,344	26,846	24,088	27,411	22,703	16,245
New Hampshire	20,692	16,371	26,817	45,964	54,111	62,479	50,322	67,141	74,505	63,941	35,959	24,013
New Jersey	270,099	273,700	446,447	538,918	556,957	608,179	588,073	668,259	641,404	604,166	536,121	376,004
New Mexico	74,800	88,304	108,621	99,978	116,257	106,384	106,984	127,460	133,571	155,478	115,707	82,377
New York	523,873	541,733	916,556	1,341,549	1,594,766	1,956,361	1,773,284	2,033,343	1,859,309	1,768,233	1,235,833	804,671
North Carolina	183,249	183,277	256,071	273,863	245,346	278,699	277,674	271,616	309,028	329,010	249,340	189,745
North Dakota	5,944	18,077	73,340	95,215	98,575	110,997	63,124	57,504	100,137	65,506	29,834	7,159
Ohio	353,758	394,973	570,510	772,145	931,846	1,067,390	990,962	1,269,338	1,199,731	1,189,267	820,485	495,299
Oklahoma	129,802	135,377	319,325	402,036	338,256	341,048	336,456	379,902	324,224	400,426	425,076	336,382
Oregon	87,782	65,614	242,716	261,343	226,447	242,417	289,768	326,499	264,850	194,405	218,781	141,617
Pennsylvania	494,929	492,059	782,956	1,004,661	1,130,779	1,320,205	1,265,520	1,622,365	1,589,949	1,353,741	1,023,784	654,358
Rhode Island	27,601	26,580	45,238	77,889	58,065	74,326	78,369	82,741	89,839	77,580	54,081	36,071
South Carolina	141,088	113,559	153,656	155,179	124,759	103,689	112,788	129,314	113,316	126,169	129,329	97,294
South Dakota	11,575	49,601	89,825	118,266	117,638	104,041	85,942	101,782	152,115	140,414	85,995	23,200
Tennessee	157,259	202,097	273,421	387,698	351,961	346,936	342,533	452,423	481,853	420,505	443,259	278,838
Texas	759,213	714,486	1,133,454	1,140,395	1,244,781	1,162,115	1,011,270	1,304,882	1,225,794	1,156,708	1,317,077	1,019,797

Utah	11,578	17,454	73,082	121,876	120,459	158,211	113,631	127,103	135,482	113,647	119,525	43,448
Vermont	3,909	4,769	12,329	36,470	49,042	47,246	48,010	70,434	63,623	71,008	31,372	7,211
Virginia	161,177	190,298	304,499	317,010	348,082	391,210	370,540	413,251	387,090	395,139	324,690	229,153
Washington	71,222	141,697	321,014	380,867	402,470	426,820	440,301	492,098	474,104	387,665	274,743	227,099
West Virginia	78,628	91,980	127,446	155,759	187,423	227,531	205,935	233,520	234,066	223,845	164,913	103,632
Wisconsin	122,543	129,769	298,126	423,005	620,854	688,215	570,814	728,869	649,502	605,603	308,084	161,994
Wyoming	14,505	14,799	51,467	70,835	79,436	88,999	88,429	104,698	102,221	84,489	52,934	26,135
Unspecified	2,177	231	22,839	0	0	0	0	8,397	0	2,592	26	0
Continental United States	8,171,109	8,625,098	13,909,370	17,297,105	18,877,762	20,105,959	18,843,367	23,174,315	22,385,024	20,843,862	16,889,640	11,216,518
Outside continental United States[1]	584,891	508,902	629,630	481,895	548,238	561,041	477,633	458,685	377,976	434,138	379,360	411,482
Total	8,756,000	9,134,000	14,539,000	17,779,000	19,426,000	20,667,000	19,321,000	23,633,000	22,763,000	21,278,000	17,269,000	11,628,000

[1] Shipments by producers to foreign countries and to noncontiguous Territories of the United States (Alaska, Hawaii, Puerto Rico, etc.), including distribution from Puerto Rican mills.

LOCAL SUPPLY

The surplus or deficiency in the quantity of cement locally available is indicated in the following table. The comparison is based on shipments from mills and on consumption as shown by State receipts of mill shipments. The 1949 deficiencies occurred in one State and six districts.

The total surplus of producing States in 1949 was distributed as follows: 23,451,774 barrels to non-cement-producing States, Alaska, and Hawaii; 3,666,101 barrels to destinations outside continental United States (excluding local consumption of Puerto Rican production); and 52 barrels to unspecified destinations.

TABLE 23.—Estimated surplus or deficiency in local supply of portland cement in cement-producing States, 1948–49, in barrels

State or division	1948			1949		
	Shipments from mills	Estimated consumption	Surplus or deficiency	Shipments from mills	Estimated consumption	Surplus or deficiency
Alabama	9,948,600	3,178,143	+6,770,457	9,394,348	2,910,444	+6,483,904
California	24,162,926	20,567,994	+3,594,932	23,201,982	19,943,561	+3,258,421
Illinois	7,573,404	10,580,915	−3,007,511	7,976,972	11,385,563	−3,408,591
Iowa	6,835,578	4,272,285	+2,563,293	6,655,208	4,844,659	+1,810,549
Kansas	7,930,965	4,213,812	+3,717,153	7,640,540	4,137,843	+3,502,697
Michigan	11,116,911	8,942,493	+2,174,418	12,747,791	9,291,483	+3,456,308
Missouri	8,428,343	5,299,347	+3,128,996	8,518,636	4,541,405	+3,977,231
Ohio	10,020,198	10,249,103	−228,905	10,157,001	10,057,975	+99,026
Pennsylvania	38,255,543	12,480,244	+25,775,299	36,905,254	12,738,153	+24,167,101
Puerto Rico	2,440,455	1,901,545	+538,910	2,171,486	1,660,362	+511,124
Tennessee	6,774,926	4,081,837	+2,693,089	5,992,571	4,139,920	+1,852,651
Texas	13,786,846	12,893,560	+893,286	14,741,805	13,183,797	+1,558,008
Colorado, Arizona,[1] Wyoming, Montana, Utah, and Idaho	5,250,131	5,156,188	+93,943	6,149,542	7,062,981	−913,439
Oregon and Washington	6,816,082	6,256,386	+559,696	6,314,030	6,590,459	−276,429
Georgia, Kentucky, Virginia, Florida, Louisiana, and South Carolina [2]	8,404,890	17,745,913	−9,341,023	9,791,088	19,045,835	−9,254,747
Indiana, Wisconsin, Minnesota, Nebraska, Oklahoma, South Dakota, and Arkansas	18,889,106	23,557,481	−4,668,375	19,391,926	24,134,819	−4,742,893
Maryland and West Virginia	4,194,481	5,626,104	−1,431,623	4,592,826	6,301,755	−1,708,929
New York and Maine	13,475,277	15,116,068	−1,640,791	13,737,319	16,991,384	−3,254,065
Total	204,304,662	172,119,418	+32,185,244	206,080,325	178,962,398	+27,117,927

[1] Arizona first began shipping in December 1949.
[2] South Carolina first began shipping in January 1949.

PRICES

The average net mill realization of all portland cement shipped from mills in 1949 advanced to $2.30 per barrel from $2.18 in 1948. The average net mill realization in each quarter of 1949 was: First, $2.33; second, $2.30; third, $2.28; and fourth, $2.30.

The composite wholesale price of portland cement, f. o. b. destination, according to the Bureau of Labor Statistics index (1926=100), was 133.8 in 1949, whereas in 1948 it was 130.4.

Average mill value per barrel, in bulk, of portland cement in the United States,[1] 1944–49

1944	$1.59	1947	$1.90
1945	1.63	1948	2.18
1946	1.72	1949	2.30

[1] Includes Puerto Rico and Hawaii.

FOREIGN TRADE [9]

Imports.—Imports of hydraulic cement decreased sharply in 1949, amounting to 109,821 barrels compared with 282,752 barrels (revised figure) in 1948, and for the most part representing purchases from Belgium-Luxembourg, Germany, Mexico, and the United Kingdom. Imports of all hydraulic cement, except white, nonstaining, and other special cement, for 1947–49 are listed by country of origin in the second table following. Imports of white, nonstaining cement in 1949 amounted to 35 barrels valued at $142.

TABLE 24.—Hydraulic cement imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Barrels	Value	Year	Barrels	Value
1945	323	$700	1948	[1] 282,752	$785,120
1946	3,734	15,531	1949	109,821	329,969
1947	4,606	28,668			

[1] Revised figure.

TABLE 25.—Roman, portland, and other hydraulic cement imported for consumption in the United States, 1947–49, by countries [1]

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Barrels	Value	Barrels	Value	Barrels	Value
Belgium-Luxembourg			104,937	$261,927	37,412	$90,767
Bulgaria			17	56		
Canada	334	$1,078	3,030	14,100	639	2,162
Dominican Republic					1,616	7,260
Germany					25,620	75,000
Mexico			149,990	397,785	16,917	40,722
Norway					11,750	32,853
United Kingdom	4,272	27,590	24,665	110,606	15,832	81,063
Total	4,606	28,668	282,629	784,402	109,786	329,827

[1] Excludes "white, nonstaining, and other special cement."

Exports.—Exports of cement in 1949 declined slightly to 4,561,899 barrels valued at $15,960,954. As indicated in the following table, shipments to North America and to South America amounted to 93 percent of the total. The largest purchasers were Canada, Cuba, Mexico, and Venezuela.

Shipments of hydraulic cement to noncontiguous Territories of the United States for the 1947–49 period are shown in an accompanying

[9] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

table. Shipments to Puerto Rico and the Virgin Islands increased over the previous year's figures, while shipments to American Samoa, Guam, and Wake Island decreased.

TABLE 26.—Hydraulic cement exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Barrels	Value	Percent of total shipments from mills
1945	6,474,721	$15,567,490	6.0
1946	5,163,362	13,484,933	3.0
1947	[1] 6,771,250	[1] 21,826,718	[1] 3.6
1948	5,922,163	20,917,176	2.9
1949	4,561,899	15,960,954	2.2

[1] Exclusive of 198,723 barrels, valued at $839,916 exported under the Army Civilian Supply Program.

TABLE 27.—Hydraulic cement exported from the United States, 1947–49, by countries

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Barrels	Value	Barrels	Value	Barrels	Value
North America:						
Bermuda	12,712	$37,443	634	$2,998	25	$110
Canada	1,100,559	3,558,874	907,400	3,416,965	1,505,976	5,080,765
Newfoundland-Labrador	53,406	143,773	1,145	4,107	1,550	3,900
Central America:						
British Honduras	3,425	16,594	250	950	1,050	4,523
Canal Zone	332,569	883,943	108,045	333,431	36,293	98,500
Costa Rica	120,716	362,731	72,599	235,924	43,187	155,430
El Salvador	138,911	481,106	47,441	169,578	33,594	136,713
Guatemala	27,623	87,893	26,224	93,942	26,656	100,385
Honduras	97,365	329,996	62,752	210,099	80,200	277,092
Nicaragua	12,696	41,414	9,452	40,225	6,167	24,804
Panama	253,512	822,452	82,379	299,747	2,059	13,532
Mexico	481,961	1,681,811	158,623	577,995	126,381	490,670
West Indies:						
British:						
Bahamas	20,185	73,357	10,085	40,396	11,365	47,118
Barbados	7,642	16,573	108	324	----------	----------
Jamaica	12,907	42,376	3,508	14,189	495	1,930
Leeward and Windward Islands	----------	----------	4,783	16,481	485	1,845
Trinidad and Tobago	68,300	198,187	20,375	63,510	1,927	8,253
Cuba	518,339	1,682,314	398,529	1,421,288	296,246	980,613
Dominican Republic	352,458	1,066,324	215,462	752,212	62,963	247,905
French West Indies	60,238	175,129	3,232	10,480	2,963	10,608
Haiti	32,277	98,639	15,757	57,193	27,058	99,989
Netherlands Antilles	36,516	115,191	137,746	470,736	78,404	259,116
Other North America	1,000	4,600	250	719	----------	----------
Total North America	3,745,257	11,920,720	2,286,779	8,233,480	2,345,044	8,085,721
South America:						
Argentina	14,287	77,095	4,455	40,141	953	1,721
Bolivia	1,880	12,907	1,546	14,393	98	694
Brazil	403,333	1,462,542	493,622	1,890,808	33,021	187,209
Chile	3,192	24,955	8,910	59,120	2,591	21,593
Colombia	337,544	1,382,686	113,195	478,302	54,453	332,329
Ecuador	85,361	255,309	9,888	34,736	61,945	221,563
Paraguay	3,960	14,126	332	2,532	2,488	13,726
Peru	91,690	257,239	21,629	74,924	3,057	18,450
Surinam	6,181	17,363	3,328	10,806	8,525	27,257
Uruguay	2,711	17,561	1,327	9,348	472	4,044
Venezuela	1,600,551	4,908,461	2,026,617	6,822,478	1,751,951	6,072,034
Other South America	5,419	17,358	68	391	75	994
Total South America	2,556,148	8,448,172	2,678,917	9,437,775	1,919,621	6,901,614

TABLE 27.—Hydraulic cement exported from the United States, 1947–49, by countries—Continued

Country	1947		1948		1949	
	Barrels	Value	Barrels	Value	Barrels	Value
Europe:						
France			486	$5,763	829	$4,264
Norway					24	385
Portugal	461	$2,737				
U. S. S. R.	751	7,242				
United Kingdom	554	3,802	190	1,476		
Other Europe	387	2,531	1,253	12,609	499	5,973
Total Europe	2,153	16,312	1,908	19,848	1,352	10,622
Asia.						
Bahrein	1,639	5,679	1,900	15,284	4,401	26,903
Ceylon	78,170	227,971	21,649	70,111	150	992
China	3,981	19,938	125	323		
French Indochina	380	1,024	689	15,848		
Hong Kong	5,901	19,168	1,750	5,198		
India	13,287	57,812			17	400
Indonesia	17,087	43,760	71,381	226,330	80,075	254,534
Japan	259	770			44,633	143,116
Korea	(1)	(1)	162,503	527,291	61,843	201,592
Kuwait	37,922	112,421	36,895	134,577	9,320	42,655
Philippines	152,117	470,590	400,397	1,321,795	17,873	70,381
Saudi Arabia	77,308	237,107	117,417	454,729	47,682	153,131
Syria	1,461	6,352				
Turkey	901	7,571			479	1,259
Other Asia	543	1,685	4,501	16,301	2,069	17,721
Total Asia	[1] 390,956	[1] 1,211,848	819,207	2,787,837	268,542	912,684
Africa:						
Egypt	167	1,550	400	3,144		
Ethiopia	1,750	4,908			750	2,580
French West Africa	1,297	3,320	1,678	5,318	6,731	21,584
Liberia	11,575	30,940	4,231	14,694	1,250	4,344
Madagascar			65,349	189,369		
Mozambique	7,064	25,807	12,238	43,446		
Nigeria	1,786	4,536	1,440	4,714	4,915	16,419
Portuguese Guinea and Angola	20,036	55,135	4,987	20,032		
Southern Rhodesia	1,325	8,200				
Union of South Africa	17,849	55,524	19,600	71,762	2,005	9,065
Other Africa	1,292	3,756	5,897	20,266	670	2,393
Total Africa	64,141	193,676	115,820	372,745	16,321	56,385
Oceania:						
French Pacific Islands	1,796	5,804	14,825	49,746	4,036	14,934
New Zealand	10,783	30,095	3,782	12,746	4,198	17,922
Other Oceania	16	91	925	2,999	2,785	11,072
Total Oceania	12,595	35,990	19,532	65,491	11,019	43,928
Grand total	[1] 6,771,250	[1] 21,826,718	5,922,163	20,917,176	4,561,899	15,960,954

[1] Exclusive of 198,723 barrels, valued at $839,916, exported to Korea under the Army Civilian Supply Program.

TABLE 28.—Hydraulic cement shipped to noncontiguous Territories of the United States, 1947–49

[U. S. Department of Commerce]

Territory	1947		1948		1949	
	Barrels	Value	Barrels	Value	Barrels	Value
Alaska	53,424	$140,051	(1)	(1)	(1)	(1)
American Samoa	25	90	495	$1,621	436	$1,687
Guam	2,987	8,798	4,467	18,330	2,199	10,510
Hawaii	547,184	1,166,942	(1)	(1)	(1)	(1)
Puerto Rico	18,905	78,184	14,964	91,313	94,955	315,871
Virgin Islands	17,360	56,196	28,971	105,647	31,074	123,471
Wake Island			630	2,757	83	359

[1] Figure not available.

TECHNOLOGY

The question of free lime in cement is one that has been discussed for many years. According to a recent report,[10] tricalcium silicate, an important compound in clinker, decomposes below 1,250° C. to form beta-Ca_2SiO_4 and secondary free lime. The report states further that these products, formed by a reaction in the solid state, are much finer in grain size (below 1 micron) than the same compounds primarily formed under the action of polyeutectic melts, especially in the clinkering process.

According to a recent article,[11] the belief that a direct relationship exists between the amount of free lime in cement and irregularity in volume changes is incorrect. Such irregularity is not caused by free lime but by other factors. The author states further that determination of free lime in cements by the Emley and analogous methods was found to be unsatisfactory. Instead, the Baikov method is recommended.

The possibility of using natural anhydrite as a substitute for gypsum wholly or in part in the manufacture of portland cement has been advanced. Some attempts have been made previously to substitute natural anhydrite for gypsum, but not on a commercial scale. In making the tests presented in a recent article,[12] seven clinkers were ground with varying percentages of gypsum, and tests made to determine the optimum amount of SO_3 for each clinker. The clinkers were then ground with this optimum amount of SO_3 in the form of mixtures of gypsum and natural anhydrite and the tests repeated. According to the article, a comparison of the results obtained with gypsum alone and with blends of gypsum and natural anhydrite indicated that, with one clinker, 25 percent and, with the others, 60 to 75 percent of the gypsum could be replaced by natural anhydrite without adversely affecting the properties of the cement.

A waterproofing admixture called "Zilicon," which is added directly to portland-cement concrete mixtures, has been announced. Its purpose is to waterproof concrete and cement mortars by providing water repellency. This integral admixture is designed for concrete, stucco, cement and brick mortar, cement plaster coat, etc.[13]

Another development of interest to the industry is the "Aerocem" cement spraying process, for applying ordinary or special mixtures of cement to almost any kind of surface. The Aerocem equipment consists of a pressure pot, a pneumatic aerator, air and fluid lines, and the Aerocem gun.[14]

Four patents relating to cement and cement concrete have been released. One, United States Patent 2,427,683, applies to slow-setting cements for use in cementing high-temperature deep wells. Adding 0.05–0.75 pound of carboxymethylcellulose or its salts per 100 pounds of dry cement retards the setting time at about 82°–104.4° by 3–10 hours. The addition of 0.05–0.50 pound of hydroxyethylcellulose per 100 pounds of dry cement retards the setting time similarly but

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[10] Journal, American Ceramic Society, vol. 32, No. 3, March 1, 1949, pp. 76–77.
[11] Journal, American Ceramic Society, vol. 32, No. 3, March 1, 1949, p. 78.
[12] A. S. T. M. Bulletin, No. 161, October 1949, pp. 56–67.
[13] Concrete, vol. 57, No. 7, July 1949, p. 42.
[14] Cement Lime and Gravel, vol. 23, No. 11, May 1949, p. 372.

in the 60°–82° temperature range.[15] United States Patent 2,466,601 describes a rotary kiln and other apparatus for burning cement.[16] United States Patent 2,458,039 describes a procedure for improving the strength and resistance of portland-cement concrete to freezing and thawing by substituting water-cooled slag for about 20 percent of the cement.[17] United States Patent 2,489,211, dated November 22, 1949, covers a countercyclone "clinkerer." [18]

During 1949 the American Society for Testing Materials, acting through its Committee C–1 on Cement, revised some of the standard specifications and adopted new tentative specifications. Revisions were proposed for the following specifications: (1) Standard Specification for Portland Cement (C 150–47), (2) Standard Method of Test for Autoclave Expansion of Portland Cement (C 151–43), (3) Standard Specifications for Masonry Cement (C 91–48), and (4) Standard Method of Test for Fineness of Portland Cement by the Turbidimeter (C 115–42). Tentative Method of Test for Air Content of Air-Entraining Portland-Cement Mortar (C 185–47) was retained without revision. The following methods and specifications were tentatively adopted: (1) Tentative Method of Test for Sodium Oxide and Potassium Oxide in Portland Cement by Flame Photometry (C — - 49 T), (2) Tentative Specifications for Flow Table for Use in Tests of Hydraulic Cement (C — - 49 T), and (3) Proposed revised Tentative Specifications for Natural Cement (C 10 - — T).[19]

It has also been announced that A. S. T. M. Committee C–1 on Cement has declared "N-Tair" acceptable as an addition to the cements covered in tentative specifications C175 and C205. N-Tair consists substantially of a sodium resinate produced from pine-wood stumps from which the bulk of the petroleum-naphtha-soluble resin acids has been removed.[20]

Another air-entraining agent, known as "Ertrane C" for use in portland cement, has been developed. It is stated to be composed essentially of sodium soap of a partially heat-treated and polymerized fatty acid-resin mixture.[21]

Other investigations and results of research on portland cement were released during 1949. These included reports on cement hydration and related problems,[22] the determination of aluminum oxide in portland cement,[23] studies of nonevaporable water content of hardened portland-cement paste,[24] and the results of research on concrete exposed to sulfate soils.[25]

[15] British Abstracts, BI, September 1948, p. 478.
[16] Journal, American Ceramic Society, vol. 32, No. 10, October 1, 1949, p. 240.
[17] Journal, American Ceramic Society, vol. 32, No. 7, July 1, 1949, p. 161.
[18] Rock Products, vol. 52, No. 12, December 1949, p. 131.
[19] Report of Committee C–1 on Cement, presented at the annual meeting of the American Society for Testing Materials, Atlantic City, N. J., June 27 to July 1, 1949.
[20] A. S. T. M. Bulletin, No. 161, October 1949, p. 17.
[21] Pit and Quarry, vol. 42, No. 2, August 1949, p. 146.
[22] Kalousek, G. L., Davis, C. W., and Schmertz, W. E., An Investigation of Hydrating Cements and Related Hydrous Solids by Differential Thermal Analysis: Jour. Am. Concrete Inst., vol. 21, No. 2, October 1949, pp. 693–712.
[23] Ford, C. L., and LeMar, L., A Polarographic Method for the Direct Determination of Aluminum Oxide in Portland Cement: Research Laboratories, Portland Cement Assoc., Bull. 28, April 1949, 12 pp.
[24] Powers, T. C., The Nonevaporable Water Content of Hardened Portland-Cement Paste—Its Significance for Concrete Research and Its Method of Determination: Research Laboratories, Portland Cement Assoc., Bull. 29, June 1949, 17 pp.
[25] McMillan, F. R., Stanton, T. E., Tyler, I. L., and Hansen, W. C., Long-Time Study of Cement Performance in Concrete, ch. 5, Concrete Exposed to Sulfate Soils: Research Laboratories, Portland Cement Assoc., Bull. 30, December 1949, 64 pp.

WORLD REVIEW

Available statistics on world production of cement in 1944–49 are shown in the following table.

TABLE 29.—World production of hydraulic cement, by countries,[1] 1944–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1944	1945	1946	1947	1948	1949
North America:						
Canada	1,141,594	1,344,934	1,835,302	1,894,956	2,242,773	2,541,536
Cuba	173,750	180,753	240,406	276,369	284,954	313,300
Dominican Republic				([2])	43,452	53,561
Guatemala	[3] 23,000	[3] 29,000	[3] 29,000	27,600	31,573	35,852
Mexico	608,400	740,400	738,000	707,800	833,444	1,227,600
Nicaragua	10,034	[3] 16,000	9,975	15,959	16,220	16,462
Panama					41,300	53,600
United States	15,716,820	17,786,688	28,403,616	32,314,655	35,626,454	36,312,780
South America:						
Argentina	1,061,809	1,087,578	1,140,529	1,363,400	1,251,770	1,445,862
Bolivia	28,154	27,174	30,742	38,828	39,130	41,546
Brazil	809,908	774,378	826,382	913,525	1,111,503	1,281,047
Chile	362,877	411,088	579,906	602,299	539,789	495,208
Colombia	281,626	302,598	332,265	346,227	363,749	475,777
Ecuador	34,691	37,504	38,497	33,231	40,369	52,250
Peru	248,522	264,892	260,617	255,644	282,373	280,500
Uruguay	189,314	216,592	272,490	279,353	278,203	([2])
Venezuela	119,670	115,784	128,329	145,881	214,513	285,000
Europe:						
Austria	([2])	([2])	387,680	281,271	721,379	1,091,012
Belgium	600,000	646,898	1,889,777	2,609,174	3,330,948	2,924,998
Bulgaria	126,044	245,100	([2])	([2])	[3] 325,000	([2])
Czechoslovakia	([2])	([2])	920,000	1,404,000	1,650,000	1,738,000
Denmark	646,837	219,996	501,835	643,200	809,923	834,000
Finland	180,221	277,679	329,792	417,737	555,800	655,984
France	1,485,560	1,576,968	2,116,428	3,920,829	5,379,000	6,443,352
Germany:						
Federal Republic	([2])	([2])	2,596,600	2,996,200	5,581,200	8,460,000
Soviet Zone			([2])	([2])	([2])	([2])
Greece	([2])	([2])	[3] 110,000	([2])	([2])	([2])
Hungary	[4] [6] 153,290	[4] [6] 38,380	163,590	209,060	([2])	[3] 640,000
Ireland	222,515	([2])	([2])	([2])	([2])	([2])
Italy	1,349,953	1,143,060	([2])	2,754,091	3,143,808	4,036,501
Luxembourg	([2])	([2])	([2])	89,272	102,900	121,000
Netherlands	214,000	231,000	402,654	519,262	588,997	564,900
Norway	321,731	141,800	436,211	472,612	526,187	592,184
Poland	([2])	[7] 300,906	1,398,915	1,521,822	1,823,857	2,200,000
Portugal	244,974	262,980	330,100	427,734	496,800	518,400
Rumania	326,000	250,000	315,000	422,000	452,000	560,000
Spain	1,843,037	1,926,052	2,145,140	2,186,338	2,330,850	2,227,675
Sweden	1,061,140	1,213,513	1,461,726	1,550,163	1,496,450	1,700,000
Switzerland	430,000	415,000	604,090	994,790	[3] 1,000,000	[3] 950,000
U. S. S. R.[3]	([2])	1,800,000	3,400,000	4,800,000	([2])	([2])
United Kingdom	4,633,188	4,121,100	6,681,545	7,071,708	8,657,762	9,364,000
Yugoslavia	([2])	([2])	586,092	1,233,180	1,188,000	([2])
Asia:						
China	[5] 1,177,890	42,500	208,057	608,692	([2])	[3] [9] 216,000
Formosa[3]	345,000				235,000	280,800
French Indochina		4,910	36,430	39,871	97,259	154,000
Hong Kong	([2])	([2])	([2])	34,800	52,200	58,700
India [10]	2,076,806	2,180,442	1,969,387	1,470,895	1,577,831	2,135,737
Indonesia		([2])	([2])	10,000	37,751	([2])
Iran	[11] [12] 38,000	[11] [12] 25,000	[12] 42,700	[11] [12] 42,714	[12] 64,795	([2])
Israel	176,499	147,237	265,935	328,394	159,865	241,393
Japan	2,959,686	1,172,273	929,000	1,236,000	1,848,000	3,274,572
Korea:						
North	1,003,002	133,700	[3] 150,000	[3] 150,000	([2])	([2])
South		5,350	10,696	18,191	17,350	24,132
Lebanon	136,326	148,471	144,900	167,116	208,800	233,000
Pakistan	([13])	([13])	([13])	([13])	327,168	([2])
Philippines	([2])	[8] 27,231	56,261	133,918	120,384	206,002
Syria	35,106	34,728	44,800	45,667	49,252	51,632
Thailand	26,400	([2])	([2])	58,800	82,800	127,200
Turkey	286,521	288,455	331,462	358,456	344,994	372,584

[1] See footnotes at end of table.

TABLE 29.—World production of hydraulic cement, by countries,[1] 1944–49, in metric tons—Continued

Country [1]	1944	1945	1946	1947	1948	1949
Africa:						
Algeria	96,445	105,035	115,410	127,815	129,867	128,075
Belgian Congo	84,776	76,264	81,514	115,441	[3] 126,942	[3] 156,914
Egypt	423,902	432,088	587,577	648,353	768,283	[3] 800,000
Eritrea	38,000	(2)	(2)	----------	(2)	(2)
Ethiopia [3]	(2)	(2)	(2)	(2)	8,000	8,000
French Morocco	109,020	76,835	175,180	218,877	262,232	264,000
Mozambique	27,932	33,919	26,275	35,858	35,858	(2)
Tunisia	58,500	59,600	83,540	115,100	162,000	167,631
Union of South Africa	1,113,600	1,050,000	1,180,200	1,251,743	1,308,000	1,363,200
Oceania:						
Australia:						
New South Wales	313,976	312,185	373,794	439,271	447,609	1,076,302
Victoria	127,971	133,407	152,763	194,777	195,488	
New Zealand	229,200	237,600	229,900	219,409	247,205	254,039
Total [14]	54,855,000	49,684,000	72,638,000	85,034,000	99,446,000	111,300,000

[1] In addition to countries listed, hydraulic cement is produced in Albania, Madagascar, Queensland, South Australia, and Tasmania, but data are not available.
[2] Data not available; estimate by senior author of chapter included in total.
[3] Estimate.
[4] Data represent Trianon Hungary after October 1944.
[5] January to June, inclusive.
[6] June to December, inclusive.
[7] April to December, inclusive.
[8] Data represent area designated as Free China during the period of Japanese occupation, and Manchuria.
[9] Manchuria only.
[10] Beginning September 1947, excludes Pakistan.
[11] Production in Government-operated plants only.
[12] Fiscal year ended Mar. 20 of year following that stated.
[13] Included in India.
[14] Estimated by senior author of chapter; excludes estimates for countries listed in footnote 1.

Chromium

By Robert H. Ridgway

GENERAL SUMMARY

SUPPLIES of chromite for United States use in 1949, virtually all obtained from foreign sources, continued to exceed consumption in all grades despite a virtual embargo on shipments from the U. S. S. R. As a result of this excess, industry stocks of all grades increased during the year, and substantial tonnages were available for the national stockpile. Chemical-grade chromite was added to the stockpiling list in 1949, making the list complete with regard to the various grades of chromite. The world sources of chromite in 1949 followed the usual pattern, although there were changes in the relative position of the supplying countries. Turkey was the largest supplier of United States chromite during the year, having shipped a record total of 275,805 short tons, of which most was high-grade metallurgical ore. The Republic of the Philippines was a close second, although most of its shipments were refractory material of the Masinloc type; substantial tonnages of metallurgical ore came from the Philippines, although this was of a somewhat lower grade than the Turkish. The Union of South Africa, the third largest supplier, was the source of by far the largest supply of chemical-grade material; in fact, the Union is considered the sole source of acceptable chemical chromite. Such ore is commonly known as Transvaal Grade B Friable. The Soviet Union, which supplied nearly 400,000 tons of high-grade material in 1948, supplied only 107,131 short tons in 1949, much of which was received early in the year. This was similar to the Russians' action with respect to manganese ore and was taken without official notice of the Soviet Government but was announced merely by the shippers, who indicated that only token shipments would be made in the future. Cuba continued to ship substantial tonnages of refractory ore and some metallurgical, although considerably less of both than in the previous year; higher production costs of refractory chromite, together with increased competition of Philippine material, caused much of the decline in production during 1949.

The total new supply of chromite in 1949, although exceeding industry requirements, was far below the all-time high of 1948. The rather high industry inventories accumulated in 1949 resulted in rejection of offers of certain grades, and receipts were below what might have been obtained under maximum market demand. Quoted prices dropped off during 1949, and many deliveries were at prices considerably below these; transactions were reported at $15 per long ton, f. o. b. United States ports, for some of the grades at the close of the year.

Consumers' stocks totaled 756,995 short tons on December 31, 1949. Of this, 325,881 tons were metallurgical, 303,110 tons were refractory, and 128,004 tons were chemical grade. Stocks of these grades December 31, 1948, were 256,770 tons, 236,724 tons, and 108,997 tons, respectively.

Salient statistics of chromite in the United States, 1945–49, in short tons

		1946		1948	1949
Total supply	928,738	761,498	1,107,128	1,545,744	1,204,344
Imports for consumption	914,765	757,391	1,106,180	1,542,125	1,203,911
Domestic production	13,973	4,107	948	3,619	433
Consumption by industry	808,120	734,759	833,357	875,033	672,773
Exports	12,366	2,158	3,435	2,894	2,382

DOMESTIC PRODUCTION

Domestic production of chromite in 1949 was the lowest since 1936. This output, 433 tons, came from one mine in Butte County, two in Del Norte County, and one in Tehama County—all in California. R. F. Helmke, operating the Lambert mine near Magalia, Butte County, shipped 162 tons; Sam J. Wilson, operating the Tyson Chrome mine, Del Norte County, shipped 160 tons; Eugene Brown shipped 54 tons from the High Plateau mine, Del Norte County; and Harry Moore shipped 57 tons from the Tedoc and Red Mountain mines in Tehama County. All of the chromite produced in 1949 is believed to have been used for metallurgical purposes.

The Pacific Northwest Alloys, Inc. (formerly the Chromium Mine & Smelting Corp., Ltd.), continued its experiments at Mead, Wash., to develop a process for producing exothermic chromium alloys from domestic materials.

Chromite production (shipments) in the United States, 1945–49, by States, in short tons, and number of producers in 1949

State	1945	1946	1947	1948	1949		
					Number of producers	Short tons	Value
California	9,607	[1] 4,107	948	274	4	433	$11,662
Oregon	4,366			3,345			
Total	13,973	4,107	948	3,619	4	433	11,662

[1] Bureau of Mines not at liberty to publish separate State totals for California and Oregon in 1946.

Chromite shipped from mines in the United States, 1880–1949 [1]

Year	Short tons	Year	Short tons	Year	Short tons	Year	Short tons
Before 1880	224,000	1897–99	--------	1917	48,972	1935	577
1880	2,563	1900	157	1918	92,322	1936	301
1881	2,240	1901	412	1919	5,688	1937	2,600
1882	2,800	1902	353	1920	2,802	1938	909
1883	3,360	1903	168	1921	316	1939	4,048
1884	2,240	1904	138	1922	398	1940	2,982
1885	3,024	1905	25	1923	254	1941	14,259
1886	2,240	1906	120	1924	323	1942	112,876
1887	3,360	1907	325	1925	121	1943	160,120
1888	1,680	1908	402	1926	158	1944	45,629
1889	2,240	1909	670	1927	225	1945	13,973
1890	4,031	1910	230	1928	739	1946	4,107
1891	1,537	1911	134	1929	301	1947	948
1892	1,680	1912	225	1930	90	1948	3,619
1893	1,624	1913	286	1931	300	1949	433
1894	4,122	1914	662	1932	174		
1895	1,949	1915	3,675	1933	944	Total	848,152
1896	880	1916	52,679	1934	413		

[1] Production of chromite before 1880 was "about 200,000 long tons" (224,000 short tons), all from Maryland and Pennsylvania, according to Mineral Resources, 1908, pt. 1, p. 760. Most of the figures for 1880–95 represent conversions to short tons from rounded long tons.

CONSUMPTION AND USES

Consumption of chromite during 1949 decreased 23 percent from 1948. This decrease resulted partly from a 12-percent drop in steel-ingot production, which resulted in lower requirements for refractories to rebuild open-hearth furnaces. The drop in consumption of metallurgical chromite (27 percent) resulted from decreases in demand for alloy steels (31 percent) that were much more evident than the decline in the over-all steel-ingot rate.

As to the various consuming industries, metallurgical consumption was off 27 percent, refractory 18 percent, and chemical 24 percent for 1949. Metallurgical and chemical consumption was less than in any war or postwar year, but refractory, which was less than 1947 or 1948, exceeded the three previous years. The percentages of metallurgical, refractory, and chemical ores used in 1949 were 43, 40, and 17 percent, only slightly changed from the comparable 1948 percentages of 45, 38, and 17 percent, respectively.

The average chromic oxide content of the various grades used in 1949 was slightly lower than in the previous year, averaging 41.3 percent Cr_2O_3, compared with 42.7 percent in 1948. In general, the metallurgical material has the highest Cr_2O_3 content, with chemical slightly lower and refractory material the lowest.

Consumption of chromite and tenor of ore used by primary consumer groups in the United States, 1941–49, in short tons

Year	Metallurgical		Refractory		Chemical		Total	
	Gross weight (short tons)	Average tenor (percent Cr_2O_3)	Gross weight (short tons)	Average tenor (percent Cr_2O_3)	Gross weight (short tons)	Average tenor (percent Cr_2O_3)	Gross weight (short tons)	Average tenor (percent Cr_2O_3)
1941	402, 208	50. 1	270, 947	34. 8	127, 135	46. 3	800, 290	44. 3
1942	479, 615	48. 5	294, 092	34. 0	118, 245	44. 8	891, 952	43. 2
1943	555, 259	48. 5	282, 178	34. 0	127, 163	44. 7	964, 600	43. 8
1944	456, 171	49. 4	264, 053	34. 2	128, 225	45. 7	848, 449	44. 1
1945	429, 644	49. 1	252, 407	34. 2	126, 069	45. 0	808, 120	43. 8
1946	376, 848	48. 3	228, 641	33. 9	129, 270	44. 9	734, 759	43. 2
1947	385, 983	47. 4	311, 018	35. 2	136, 356	44. 7	833, 357	41. 1
1948	395, 417	48. 2	327, 795	33. 8	151, 821	45. 5	875, 033	42. 7
1949	288, 518	47. 6	268, 925	33. 5	115, 330	44. 1	672, 773	41. 3

Consumption of ferrochromium in the United States in 1949 dropped sharply to 87,764 short tons, compared with 122,753 tons in 1948 and 113,491 tons in 1947. In addition to this ferrochromium, substantial tonnages of chromium metal and chromium in the form of chromium briquets and Chrom-X were used in the manufacture of steels and chromium alloys; some chromite was used direct in the manufacture of stainless steel.

Specifications.—The mineral chromite does not have a fixed chemical composition. It is usually spoken of as $Cr_2O_3 \cdot FeO$ but also contains varying proportions of iron, alumina, magnesia, lime, and silica. These additional elements, although lowering the grade of the material in terms of chromium content, are essential to certain applications, as may be seen from the usual trade specifications outlined below.

For metallurgical use, such as the manufacture of ferrochrome, chromite generally should contain a minimum of 48 percent Cr_2O_3, with a chromium:iron ratio of not less than 3:1. Further, the ore should be hard, and lumpy. Usual specifications call for 6-inch maximum size of piece, with not more than 10 to 15 percent through a ½-inch screen. Silica is undesirable, and combined alumina and magnesia of over 25 percent may be objectionable.

Refractory-grade chromite usually contains about 63 percent combined Cr_2O_3 and Al_2O_3, with 57 percent a common minimum. Iron and silica should be low, usually around 10 and 5 percent, respectively.

Hard lump ore is desirable for making bricks, and ground material is suitable for cement. Magnesia content is around 15 percent.

Chemical-grade chromite should contain a minimum of 45 percent Cr_2O_3. High iron is not harmful within reasonable limits; a common chrome: iron ratio is 1.6 : 1. Silica must be less than 8 percent and sulfur low. Fines and concentrates are often preferred because they disintegrate readily in processing.

Metallurgical Uses.—The main sources of metallurgical chromite for the United States are Turkey, Southern Rhodesia, New Caledonia, Union of South Africa, and the Republic of the Philippines. Much of the chromite used is considerably lower in quality than the standard specified above. The lower grades, however, result in somewhat lower-grade ferrochromium, the alloy most commonly used in adding chromium to steels. In general, ferrochromium is made in two grades—high carbon and low carbon; the lower carbon is essential in the manufacture of certain grades of steel, especially stainless. Except for the chromite used direct in steel production, all the metallurgical grades are consumed in electric furnaces in the manufacture of chromium ferro-alloys. Steels that depend on chromium include some structural steels, tool steels, high-speed steels, bearing steels, and stainless steels.

Refractory Uses.—Chromite refractories are valuable in lining steel-making furnaces because of their peculiar property of being resistant to both acid and basic slags. Because of this neutral chemical characteristic, these refractories can be built into furnaces between basic bottoms and acid roofs. Prepared chromite is also used in a crushed condition to repair furnace linings. A refractory composed of chromite and magnesite also is used extensively for furnace linings.

Chemical Uses.—The largest use for chemical chromite is in the manufacture of pigments and tanning of leather, and surface treatment of metals represents the next most important use. In all chemical uses, sodium bichromate is the primary chemical produced from chromite. Chromium metal, although a metallurgical material, is also produced from chemical-grade chromite with sodium bichromate as the intermediate product. The metal is finding new substantial markets in the production of high-temperature alloys, such as are used in engines for jet aircraft, and for antifriction purposes, where it is deposited by electrolytic methods. The third largest use mentioned (surface treatment of metals) is again a use for sodium bichromate in cleansing, pickling, red dip for brass, and galvanizing.

PRICES

Prices on imported chromite are quoted on a long-ton basis f. o. b. cars, Atlantic ports, plus ocean freight differentials for delivery to the west coast. Domestic shipments are sold f. o. b. nearest rail point. Quoted prices shown in the accompanying table from the magazine Steel reflect the continued high level of supply during 1949 through lower prices.

Price quotations for various grades of chromite in 1949

[Steel]

Source	Cr_2O_3 (percent)	Cr : Fe ratio	Prices per long ton [1]	
			Beginning of year	End of year
Indian and African	48	3:1	$39.00	$37.50
Do	48	2.8:1	37.50	35.00
Do	48		31.00	28.50-29.00
South African (Transvaal)	50		29.50-30.50	28.50-29.00
Do	48		29.00-30.00	27.00-28.00
Do	45		26.50	19.50-21.00
Do	44		25.50-26.00	19.00-20.00
Rhodesian	48	[2] 3:1	39.00	37.50
Do	48		30.00	28.00-29.00
Do	45		27.00-27.50	20.00-21.00
Brazilian—nominal	44	[2] 2.5:1	33.65	32.00
Domestic (sellers nearest rail)	48	3:1	39.00	39.00

[1] Gross ton f. o. b. cars, New York, Philadelphia, Baltimore, Charleston, S. C., plus ocean freight differential for delivery to Portland, Oreg., or Tacoma, Wash.
[2] Lump.

Prices of ferrochromium remained steady during 1949 at 20.5 cents per pound of contained chromium for high carbon and 28.75 cents per pound for low carbon (0.06 percent carbon). Chromium metal (97 percent Cr min., 0.50 percent C max.) remained at $1.03 per pound of contained chromium during the year. The prices for metal and alloys given here are for bulk, carload lots. Basic chrome brick prices were unchanged during 1949 at $69 per net ton, f. o. b. Baltimore, Md., or Chester, Pa.

FOREIGN TRADE [1]

Imports of chromite in 1949 decreased 22 percent from 1948 and amounted to 1,203,911 short tons containing 533,591 tons of Cr_2O_3; the value was $24,189,442, a drop of 27 percent. According to the Bureau of the Census, chemical imports constituted 18 percent of total imports, metallurgical 56 percent, and refractory 26 percent.

Imports of ferrochromium in 1949 totaled 7,491 short tons containing 4,012 tons of Cr and were valued at $1,279,598. Of the imports, 7,367 tons originated in Canada and 124 tons in Japan.

Exports of ferrochromium totaled 2,200 short tons, of which Italy and Austria were the largest recipients. Chromic acid exports totaled 1,404,227 pounds valued at $422,471. Exports of chromite were 2,382 short tons valued at $74,034.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Chromite imported for consumption in the United States, by countries and by grades, 1948–49

[U. S. Department of Commerce]

Country	Chemical grade			Metallurgical grade			Refractory grade			Total		
	Short tons		Value	Short tons		Value	Short tons		Value	Short tons		Value
	Gross weight	Cr_2O_3 content		Gross weight	Cr_2O_3 content		Gross weight	Cr_2O_3 content		Gross weight	Cr_2O_3 content	
1948												
Brazil	1,792	860	$35,275							1,792	860	$35,275
Canada				145	56	$5,520	49	26	$1,964	194	82	7,490
Cuba	3,903	1,874	49,661	24,806	8,428	[1] 336,925	134,792	47,511	1,574,895	163,501	57,813	[1] 1,961,481
Guatemala				1,416	680	53,088				1,416	680	53,088
Malta, Gozo, and Cyprus	5,455	2,509	126,420							5,455	2,509	126,420
New Caledonia [2]				46,452	24,884	1,168,960				46,452	24,884	1,168,960
Philippines	3,369	1,483	28,353	21,624	9,438	306,312	210,591	70,748	1,877,249	235,584	81,669	2,211,914
Sierra Leone [3]				8,288	3,481	140,900				8,288	3,481	140,900
Southern Rhodesia	1,117	525	16,674	108,345	51,224	1,992,107	16,918	7,871	311,578	126,380	59,620	2,320,359
Turkey	[1] 5,013	[1] 2,290	[1] 118,020	[1] 227,941	[1] 107,585	[1] 7,059,794	20,532	9,771	728,748	253,486	119,646	7,906,562
Union of South Africa	159,230	73,174	1,268,659	67,437	31,072	902,334	66,077	29,252	520,209	292,744	133,498	2,691,292
U. S. S. R.	17,668	8,481	602,663	376,298	181,637	13,421,492				393,966	190,118	14,024,155
Yugoslavia				12,867	5,863	361,763				12,867	5,863	361,763
Total	[1] 197,547	[1] 91,196	[1] 2,245,725	[1] 895,619	[1] 424,348	[1] 25,749,201	448,959	165,179	5,014,733	1,542,125	680,723	[1] 33,009,659
1949												
Cuba				13,513	4,762	191,361	77,856	27,459	1,004,853	91,369	32,221	1,196,214
India				8,095	3,837	163,807				8,095	3,837	163,807
New Caledonia [2]				59,255	31,213	1,484,725	10,754	5,756	275,347	70,009	36,969	1,760,072
Philippines	23,520	10,920	328,223	64,999	29,673	1,184,434	184,451	61,415	1,659,864	272,970	102,008	3,172,521
Sierra Leone [3]				10,304	4,122	174,000				10,304	4,122	174,000
Southern Rhodesia				83,891	39,654	1,795,197	10,348	4,877	186,632	94,239	44,531	1,981,829
Turkey	19,878	9,540	684,068	254,252	121,288	8,149,424	1,680	806	45,750	275,805	131,634	8,879,242
Union of South Africa	166,772	76,855	1,400,515	64,269	30,659	984,478	32,857	14,487	219,961	263,898	122,001	2,604,954
U. S. S. R.				107,131	51,424	3,932,975				107,131	51,424	3,932,975
Yugoslavia				10,091	4,844	323,828				10,091	4,844	323,828
Total	210,165	97,315	2,412,806	675,800	321,476	18,384,229	317,946	114,800	3,392,407	1,203,911	533,591	24,189,442

1 Revised figure.
2 Classified as French Pacific Islands.
3 Classified as British West Africa

WORLD REVIEW

Cyprus.—The Cyprus Chrome Co., Ltd., having expanded its operations and installed a gravity concentrator, is reported to have treated 11,394 long tons of ore to produce 5,196 tons of concentrates in 1948. A total of 6,790 long tons of lump ore and concentrates were exported.[2]

Greece.—Although Greece was a rather productive source of chromite during World War II, there has been only small production in recent years. In 1949 a trade agreement to ship small tonnages of chromite to France was reported, and reopening the Tsagli Chrome mine near Volos was planned. This was to be possible as a result of rebuilding the wharves at Volos and rehabilitating the railway.[3]

India.—Chromite occurs in the Zhob Valley, Baluchistan; Singhbhum district, Bihar; Keonjhar, Oressa; and Hasan, Mysore.[4]

Exports of chromite from India amounted to only 5,002 long tons in 1948, compared with 8,633 tons in 1947. Of the 1948 exports, 1,180 tons went to Belgium, 500 tons to Egypt, 2,500 tons to Norway, and 822 tons to Sweden.

Madagascar.—The Government newspaper "Informations de Madagascar" on July 19, 1949, described the discovery of a chromite deposit along the Ivoloina River, near Tamatave, in the district of Tamatave, on the east coast of Madagascar. The deposit was reported to be large, and it was stated that a company called Le Chrome Malgache has been formed to develop the property. A small shipment of 300 tons was reported sent to France.

New Caledonia.—In production of chromite, New Caledonia has risen substantially since 1946, and a total of 75,021 metric tons was reported in 1948. Most of this material is high-grade metallurgical ore. It is said [5] that operations are now controlled by the Sté. Caledonienne du Chrome, a combination of the five leading producers.

Philippines.—A lack of demand for chromite in the United States resulted in shut-downs or drastic reductions in production at several of the important mines in the Philippines late in 1949. A stoppage at the Masinloc chromite deposits was reported in December; other chromite properties were completing present contracts.[6]

Sierra Leone.—The most important deposits of chromite in Sierra Leone are the Lago, 6 miles north of Hangsha, 186 rail miles from Freetown. Most of the ore is exported to the United States.[7]

Southern Rhodesia.—Chromite is reported to represent over 10 percent of the total value of Southern Rhodesia's mineral production.[8]

Turkey.—It was reported in 1949 that a trade agreement was reached whereby Turkey would provide Austria with at least 40,000 tons of chromite per year.[9]

A new chromite deposit with an estimated reserve of 300,000 tons was prospected recently at Sori, 15 kilometers from Guleman, Western Anatolia.[10]

Union of South Africa.—Chromite occurs in very large tonnages in the Transvaal, which is one of the largest producing areas in the

[2] Mining Journal (London), vol. 233, No. 5948, Aug. 20, 1949, p. 764.
[3] Metal Bulletin (London), No. 3394, May 24, 1949, p. 15.
[4] Metal Bulletin (London), No. 3409, July 19, 1949, p. 19.
[5] Mining Journal (London), vol. 233, No. 5946, Aug. 6, 1949, p. 712.
[6] Engineering and Mining Journal, vol. 150, No. 12, December 1949, pp. 131–132.
[7] Metal Bulletin (London), No. 3415, Aug. 12, 1949, p. 11.
[8] Metal Bulletin (London), No. 3413, Aug. 5, 1949, p. 13.
[9] Metal Bulletin (London), No. 3383, Apr. 12, 1949, p. 13.
[10] Metal Bulletin (London), No. 3407, July 12, 1949, p. 17.

World production of chromite, by countries, 1942–49, in metric tons

[Compiled by Pauline Roberts]

Country	1942	1943	1944	1945	1946	1947	1948	1949
North America:								
Canada	10,393	26,848	24,543	5,221	2,821	1,961	1,556	242
Cuba	286,470	354,152	192,131	172,626	174,350	159,209	116,624	97,368
Guatemala	529	374	97	443	47	625	474	300
Mexico	17	—	—	(1)	—	—	—	(2)
United States	102,400	145,259	41,394	12,676	3,726	860	3,283	393
South America:								
Argentina	210	250	181	3,000	—	—	—	(2)
Brazil (exports)	5,776	7,813	4,721	1,490	174	—	1,626	(2)
Europe:[3]								
Albania	37,797	[4] 31,091	—			—	[5] 16,500	(2)
Bulgaria	5,000	5,000	5,000	—	—	(2)	(2)	(2)
Greece	24,300	15,500	18,295	2,413	9,062	2,640	1,500	3,381
Portugal	1,275	1,267	1,111	1,669	1,530	533	(2)	(2)
Sweden	80	224	127	—	—	—	—	(2)
United Kingdom	520	294	116	—	—	—	(2)	(2)
Yugoslavia	[6] 100,000	[6] 65,000	[6] 10,000	[6] 10,000	[6] 10,000	(2)	(2)	(2)
Asia:								
Cyprus (exports)	2,936	7,986	469	1,070	1,158	5,283	6,899	14,875
French Indochina	3,570	6,510	2,300	—	—	—	—	(2)
India	50,380	33,789	40,190	31,642	45,511	35,274	22,917	(2)
Iran [7]	435	1,267	12	—	—	(2)	(2)	(2)
Japan	67,540	58,520	71,135	28,539	7,079	2,347	9,340	(2)
Pakistan	(8)	(8)	(8)	(8)	(8)	22,040	17,707	[6] 15,000
Philippines	[6] 50,000	[6] 60,000	[6] 70,000	(2)	58,930	195,185	256,854	246,744
Turkey	116,342	154,512	182,108	146,716	103,167	102,875	285,353	434,117
U. S. S. R.[3]	[5] 400,000	[5] 325,000	[6] 300,000	[6] 300,000	[6] 300,000	[6] 500,000	[6] 600,000	[6] 350,000
Africa:								
Egypt	312	910	150	150	—	266	191	(2)
Sierra Leone	10,726	16,306	9,851	578	10,301	16,769	7,886	(2)
Southern Rhodesia	348,314	287,453	277,051	186,318	151,433	155,149	230,703	243,506
Union of South Africa	337,620	163,232	88,909	99,090	212,253	373,094	412,783	326,976
Oceania:								
Australia:								
New South Wales	365	412	246	287	—	—	—	(2)
Queensland	—	—	1,125	—	—	—	—	(2)
New Caledonia	67,610	46,952	55,229	40,826	24,946	50,530	75,021	[6] 75,000
Total (estimate)	2,031,000	1,816,000	1,397,000	1,100,000	1,117,000	1,672,000	2,105,000	1,859,000

[1] Less than 1 ton.
[2] Data not available; estimate by author of chapter included in total.
[3] Output from U. S. S. R. in Europe included with U. S. S. R. in Asia.
[4] January to September, inclusive.
[5] Planned production as reported.
[6] Estimate.
[7] Fiscal year ended March 20 of year following that stated.
[8] Included with India.

Exports of chromite from Turkey, by destination, 1935–39 (average) and 1946–48, in metric tons[1]

Destination	1935–39 (average)	1946	1947	1948
Czechoslovakia	729	—	10	940
France	17,272	7,031	34,524	24,595
Germany	67,180	—	1,727	—
Italy	12,619	2,518	7,925	1,509
Sweden	34,716	8,375	44,650	2,681
Switzerland	216	—	—	—
United Kingdom	2,310	2,540	6,735	6,385
United States	22,803	8,178	69,240	239,675
Other countries	21,114	10,736	18,966	30,321
Total	178,944	39,378	183,777	306,106

[1] U. S. consular report 24, Ankara, May 5, 1949.

world. It is the only producer of acceptable chemical grade. Railroad inadequacies, which formerly restricted shipments of chromite from the South African fields, have been largely eliminated. A report on an investigation of the Bushfeld chromite was made in 1949.[11]

[11] South African Mining and Engineering Journal, vol. 66, No. 2937 [May 28, 1949] pp. 417-419.

Clays

By Robert W. Metcalf and A. M. Linn [1]

GENERAL SUMMARY

CLAY production decreased 7 percent in 1949, and shipments of the principal types of structural clay products also were somewhat smaller than in 1948. All classifications of clay herein discussed decreased, ranging from 4 percent for miscellaneous clays to 17 percent for ball clays.

The demand for common clays and shales (miscellaneous clays) remained heavy, and their use in portland cement increased 4 percent. Common clays and shales comprised nearly all of the clay used in portland and other hydraulic cements and 83 percent of that used for heavy clay products.

Sales of kaolin and ball clay declined 10 and 17 percent, respectively, in 1949, compared with 1948, although use of kaolin in rubber and of ball clay in high-grade tile each was somewhat larger than in 1948.

Salient statistics of the clay industry in the United States, 1948–49

	1948		1949	
	Short tons	Value	Short tons	Value
Domestic clay sold or used by producers:				
Kaolin or china clay	1,568,848	$19,756,738	1,415,537	$19,007,547
Ball clay	298,979	3,342,647	248,883	3,064,439
Fire clay, including stoneware clay	9,849,914	29,424,034	8,571,844	25,358,503
Bentonite	921,560	7,136,308	867,243	6,938,752
Fuller's earth	342,081	5,273,851	320,906	5,199,642
Miscellaneous clays	24,746,599	20,414,694	23,725,565	19,622,568
Total sold or used by producers	37,727,981	85,348,272	35,149,978	79,191,451
Imports:				
Kaolin or china clay	99,930	1,650,102	77,226	1,156,803
Common blue and Gross Almerode	32,195	460,422	24,123	298,450
Fuller's earth	129	2,092	389	7,859
Other clay	3,687	29,454	3,367	17,287
Total imports	135,941	2,142,070	105,105	1,481,399
Exports:				
Kaolin or china clay	19,074	319,294	21,839	362,615
Fire clay	[illegible]	[illegible]	80,736	766,195
Other clay (including fuller's earth)	[1] 145,293	[1] 3,883,610	142,308	3,666,775
Total exports	266,849	5,138,136	244,883	4,795,585

[1] Revised figure.

After 11 years of constantly increasing output, production of bentonite in 1949 decreased 6 percent compared with 1948, the peak year. The 1949 figure—867,243 tons—still was higher than in any year except 1948. Use as foundry-sand bond fell sharply; rotary

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

drilling mud showed a moderate decrease, but filtering and decolorizing oils (raw and activated earths) were 5 percent greater than in 1948.

Total production of fuller's earth in 1949 decreased moderately, although its use in insecticides and fungicides and as rotary drilling mud showed large gains compared with 1948.

Owing to the coal and steel stoppages, production of fire clay in 1949 declined substantially compared to the previous year. Use in heavy clay products was only slightly less than in 1948.

Price quotations of clay and clay products in 1949, as given in trade journals, generally remained at the same levels as in 1948, except for certain grades of domestic and imported kaolins, which increased moderately.

Imports of kaolin or china clay in 1949 declined to 77,226 short tons, which, except for the war years 1941–45, were the lowest receipts in 50 years. Imports of common blue and ball clays, including Gross Almerode, also decreased sharply in 1949. The average unit value of imports of both kaolin and blue and ball clays dropped more than $1.50 per ton. The source of each of these two types of clay in 1949 was largely United Kingdom, with very small amounts of kaolin from Canada and Czechoslovakia and small quantities of common blue and ball clays from Canada and Germany. Exports of kaolin or china clay in 1949 rose 14 percent compared with 1948, and 88 percent of the total was shipped to Canada. Fire-clay exports, largely also to Canada, decreased 18 percent. Exports of the three classes of clay shown had a wide distribution, reaching all six continents.

CONSUMPTION AND USES

The clay-consumption data shown in the accompanying table for kaolin, ball clay, bentonite, and fuller's earth are comparable with statistics published in Minerals Yearbooks for all previous years. However, the fire-clay and miscellaneous clay data, beginning with 1944, include captive tonnage and therefore are not comparable with earlier years. A discussion of these differences appeared in Minerals Yearbook, 1944 (pp. 1326–1338).

Heavy clay products in 1949 consumed 6 percent less clay than in 1948 and comprised 57 percent of the total clay produced. Clays used in portland and other hydraulic cements amounted to 19 percent of the output of all clays; refractories, 15 percent; paper filler and coating clays, 2 percent; and rotary drilling mud, filtering and decolorizing oils, and pottery, 1 percent each. The remainder was consumed for a large number of miscellaneous purposes.

Although most of the uses of clays declined in tonnage in 1949 compared with the previous year, several gained over 1948. Among those increasing were linoleum, 5 percent; enameling, 6 percent; portland and other hydraulic cements, 4 percent; rubber, 17 percent; and insecticides and fungicides, 45 percent. Important classifications with decreases were refractories, 20 percent; pottery, 17 percent; paper filler and coating, 13 percent; rotary-drilling mud, 10 percent; filtering and decolorizing oils, 7 percent; and heavy clay products, 6 percent.

Clay sold or used by producers in the United States in 1949, by kinds and uses, in short tons

Use	Kaolin	Ball clay	Fire clay and stoneware clay	Bentonite	Fuller's earth	Miscellaneous clay, including slip clay	Total
Pottery and stoneware:							
Whiteware, etc.	118,456	194,177					312,633
Stoneware, including chemical stoneware		520	36,773				37,293
Art pottery and flower pots	3,232	5,245	26,544			12,404	47,425
Slip for glazing	640	200				511	1,351
Total	122,328	200,142	63,317			12,915	398,702
Tile, high-grade	22,233	27,349	118,199			404	168,185
Kiln furniture:							
Saggers, pins, stilts	5,584	636	16,223				22,443
Wads			1,752				1,752
Total	5,584	636	17,975				24,195
Architectural terra cotta		1,270	9,400			6,000	16,670
Paper:							
Filler	385,500	300					385,800
Coating	376,755						376,755
Total	762,255	300					762,555
Rubber	197,341		27,148			2,338	226,827
Linoleum	26,650		8,933				35,583
Paints:							
Filler or extender	12,294						12,294
Calcimine	1,085		897				1,982
Total	13,379		897				14,276
Portland and other hydraulic cements	54,749		3,166	35		6,618,184	6,676,134
Refractories:							
Firebrick and block	71,326	11,325	3,754,420				3,837,071
Bauxite, high-alumina brick			60,984				60,984
Fire-clay mortar, including clay processed for laying firebrick	41,382		255,683				297,065
Clay crucibles	463	25	558				1,046
Glass refractories	2,332	25	4,701				7,058
Zinc retorts and condensers			33,976				33,976
Foundries and steelworks	4,683	228	654,197	178,867		23,310	861,285
Other refractories	630		46,580			218	47,428
Total	120,816	11,603	4,811,099	178,867		23,528	5,145,913
Heavy clay products: Common brick, face brick, paving brick, drain tile, sewer pipe, and kindred products	5,082		3,430,723			16,474,893	19,910,698
Miscellaneous:							
Rotary-drilling mud			1,051	313,083	30,411	146,789	491,334
Filtering and decolorizing oils (raw and activated earths)				303,797	171,159[1]		474,956
Other filtering and clarifying	9,647			2,712	3,659		16,018
Artificial abrasives	7,129		179				7,308
Absorbent uses (oily floors, etc.)	3,313				69,070		72,383
Asbestos products	2,857		539				3,396
Chemicals	16,853		75,346	947			93,146
Enameling	2,240	1,580	30				3,850
Fertilizers	12,979					600	13,579
Filler (other than paper or paint)	3	6,000				2,614	8,617
Insecticides and fungicides	14,956			3,656	37,342	265	56,219
Plaster and plaster products	4,800		2				4,802
Concrete admixture, sealing dams, etc.				1,196			1,196
Other uses	10,343	3	3,840	62,950	9,265	437,695	[illegible]
Total	85,120	7,583	80,987	688,341	320,806	[illegible]	1,770,[illegible]
Grand total:							
1949	1,415,537	248,883	8,571,844	867,243	320,806	23,725,565	35,[illegible],978
1948	1,568,848	298,979	9,840,914	921,[illegible]	342,061	24,746,[illegible]	37,[illegible]

[1] Comprises the following: Mineral oils, 151,353 tons; vegetable oils, 19,806 tons.

CHINA CLAY OR KAOLIN

Domestic production of china clay or kaolin in 1949 declined 10 percent from the record year 1948 to 1,415,537 short tons; it was slightly less than 1947 but higher than in any prior year. The total value decreased only 4 percent and was the highest value reported, except for the peak year, in realization (1948). The generally upward trend of kaolin production in recent years is clearly shown in the accompanying chart (fig. 1).

As in other recent years, kaolin was consumed in 1949 chiefly in four fields—paper manufacture (762,255 short tons or 54 percent of the total china clay), rubber compounding (197,341 tons or 14 percent), pottery (122,328 tons or 9 percent), and refractories (120,816 tons or 9 percent). The remainder was used for a wide variety of purposes, including cement, high-grade tile, fertilizers, insecticides, chemicals, paint filler or extender, calcimine, and linoleum. Decreases in kaolin consumption in 1949 compared with 1948 were reported in the manufacture of high-grade tile (24 percent); whiteware manufacture and refractories (17 percent each); and paper (13 percent). Increases were noted in rubber, glass refractories, foundries, plaster, and unspecified uses.

Kaolin sold or used by producers in the United States, 1948–49, by States

State	Sold by producer		Used by producer		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948						
Alabama, Florida, and North Carolina	64,614	$1,106,387			64,614	$1,106,387
California	(1)	(1)	(1)	(1)	25,562	352,538
Georgia	1,018,427	13,941,390	117,013	$701,308	1,135,440	14,642,698
Pennsylvania	(1)	(1)	(1)	(1)	50,021	190,998
South Carolina	(1)	(1)	(1)	(1)	283,485	3,347,078
Other States [2]	334,671	3,905,887	34,123	101,766	9,726	117,039
Total	1,417,712	18,953,664	151,136	803,074	1,568,848	19,756,738
1949						
Alabama, Florida, and North Carolina	52,703	942,042			52,703	942,042
California	(1)	(1)	(1)	(1)	16,068	397,800
Georgia	939,238	13,463,936	64,153	342,400	1,003,391	13,806,336
Pennsylvania	(1)	(1)	(1)	(1)	52,478	201,576
South Carolina	(1)	(1)	(1)	(1)	274,458	3,488,054
Other States [2]	323,800	4,150,180	35,643	108,989	16,439	171,739
Total	1,315,741	18,556,158	99,796	451,389	1,415,537	19,007,547

[1] Included with "Other States."
[2] Includes States indicated by footnote 1 and Illinois, Utah, and Virginia.

Shipments of kaolin came from 10 States in 1949, the same number as in 1948, but 90 percent of the total in 1949 was mined in two States—Georgia (71 percent) and South Carolina (19 percent). Pennsylvania ranked third, with 4 percent of the total production. Other States in which kaolin was produced were Alabama, California, Florida, Illinois, North Carolina, Utah, and Virginia. Of the States or groups of States shown in the accompanying table, all except Pennsylvania produced less kaolin in 1949 than in 1948.

Georgia kaolin sold or used by producers, 1945–49, by uses

Year	China clay, paper clay, etc.			Refractory uses			Total kaolin		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton		Total	Average per ton
1945	616,736	$6,305,132	$10.22	85,652	$379,395	$4.43	702,388	$6,684,527	$9.52
1946	798,739	9,075,123	11.36	119,013	595,926	5.01	917,752	9,671,049	10.54
1947	902,554	12,034,383	13.33	129,459	721,658	5.57	1,032,013	12,756,041	12.36
1948	1,006,325	13,866,799	13.78	129,115	775,899	6.01	1,135,440	14,642,698	12.90
1949	902,433	13,229,888	14.66	100,958	576,448	5.71	1,003,391	13,806,336	13.76

Quotations on Georgia kaolin, as reported in E&MJ Metal and Mineral Markets, for filler and ceramic grades were given as $8.50 to $9.50 per ton for crushed material and $13 to $17 for pulverized, in paper bags. Quotations on kaolins used for saggars and as coating clays and "specialties" were discontinued by the above-noted journal after the middle of 1949. North Carolina china clays, ceramic grades in bulk, carlots, were quoted at $18 to $20 per ton, depending on type. Through March 1949, Florida kaolins were quoted by the same source at $16.75 per ton in bulk for washed and crushed material; $20.75 for washed and air-floated clays; and $35 for air-floated enamel clay. In April these quotations were raised to $18.75 per ton for washed and crushed kaolin; $24.25 for washed and air-floated; and $38.50 for air-floated enamel clay and did not change during the balance of the year. Crude Pennsylvania kaolin was quoted throughout 1949 at $5 to $7.50 per ton and "purified" kaolin at $21 to $24.

Prices of imported china clay at the beginning of 1949 were quoted in Oil, Paint and Drug Reporter, ex dock (Baltimore, Boston, Norfolk, and Philadelphia), at $16 to $35 per net ton for white lump in bulk, $45 per ton for powdered material in carlots and powdered, ex warehouse, l. c. l., $50 to $55. Beginning at the end of October (and maintained through the rest of the year), these quotations were given as follows: White lump, carlots, ex dock (Philadelphia and Portland, Maine), $19 to $40 per long ton; powdered, ex dock, in bags, $35 to $45 per net ton; and powdered, l. c. l., ex warehouse, $45 to $60. The average value of domestic kaolin sold or used as reported to the Bureau of Mines in 1949 rose to $13.43 compared with $12.59 in 1948 and $12 in 1947.

Imports of kaolin in 1949 dropped 23 percent compared with 1948 and except for the war years 1941 through 1945, were the smallest receipts at United States ports during the last 50 years. Of the 1949 imports, totaling 77,226 short tons, 76,448 tons originated in the United Kingdom. The remainder comprised small tonnages from Canada and Czechoslovakia.

Exports of kaolin or china clay in 1949 rose 14 percent compared with 1948 to 21,839 short tons, of which 88 percent was shipped to Canada. Small tonnages also were sent to Mexico, Central and South America, Europe, Africa (Union of South Africa), Asia (Japan and Indonesia), and Australia.

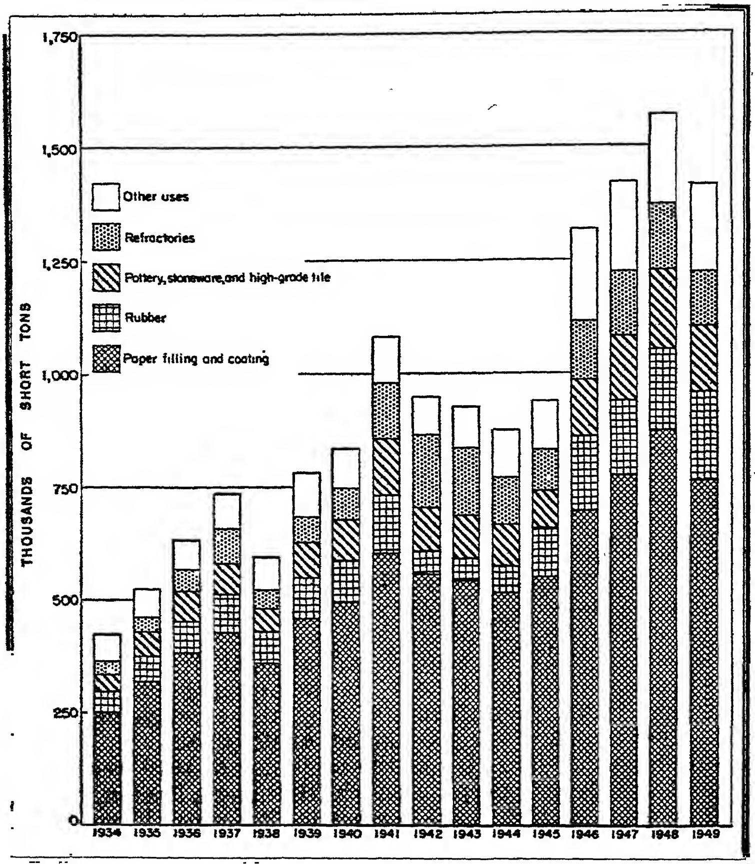

FIGURE 1.—Kaolin sold or used by domestic producers for specified uses, 1934–49.

Prospecting techniques and mining methods in the kaolin-producing States of the Southeast [2] and the dry mining of kaolin in South Carolina [3] were described by Tyler. The preparation and industrial applications of kaolin were described.[4]

BALL CLAY

Sales of ball clay in 1949 were 17 percent less than in 1948 and 8 percent lower in value. The tonnage was slightly higher than the 1945–49 average and larger than in any years except 1947 and 1948. The total value was the second highest recorded, topped only by 1948. For the seventh year, Tennessee has had the largest share of output—53 percent of ball-clay production in 1949, or 132,337 short tons, followed by Kentucky with 36 percent or 89,281 tons. The balance was produced in Maryland, Mississippi, and New Jersey. Kentucky

[2] Tyler, Paul M., Kaolin Mining in the South: Min. Cong. Jour., vol. 35, No. 6, June 1949, pp. 31–34.
[3] Tyler, Paul M., Modernizing Dry Kaolin Mining in South Carolina: Eng. and Min. Jour., vol. 150, No. 6, June 1949, pp. 56–58.
[4] Kaolin Clays and Their Industrial Uses: J. M. Huber Corp., New York, 1949, 141 pp.

and Tennessee decreased 14 and 24 percent, respectively, compared with 1948; increases were reported from Maryland and New Jersey.

Ball clay sold by producers in the United States, 1947–49, by States

State	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Kentucky	99,951	$1,072,203	103,426	$1,155,530	89,281	$1,076,531
Maryland, Mississippi, and New Jersey	22,931	262,947	21,756	284,588	27,265	327,427
Tennessee	146,168	1,588,610	173,797	1,902,529	132,337	1,660,481
Total	269,050	2,923,760	298,979	3,342,647	248,883	3,064,439

Ball clays are consumed chiefly in making whiteware; sales for this purpose in 1949 decreased 20 percent compared with 1948. On the other hand, the use of ball clay in high-grade tile, architectural terra cotta, and enameling showed increases (15 percent for high-grade tile and 27 percent for enameling). Over 80 percent (200,142 short tons) of the national output in 1949 was sold for use in pottery; 11 percent (27,349 tons) in high-grade tile; 5 percent (11,603) in refractories; and the remaining 4 percent for enamel, paper filler, and miscellaneous uses.

Price quotations on ball clay in 1949, appearing in E&MJ Metal and Mineral Markets, did not change during the year and were as follows: Tennessee—crude ball clay, $10 per short ton, and air-floated and pulverized, $19.50 per ton; Maryland—shredded, in bulk, $7 to $9, and air-floated, in bags, $14 to $17.50 per ton. No quotations on Kentucky ball clay in 1949 were given in E&MJ Metal and Mineral Markets. The average value per ton of ball clay in 1949 as reported by the producers to the Bureau of Mines was $12.31 compared with $11.18 in 1948 and $10.87 in 1947.

Imports of common blue and ball clay and Gross Almerode clays in 1949 declined 25 percent in quantity and 35 percent in value compared with 1948. Unmanufactured blue and ball clays comprised the major share of the imports; United Kingdom supplied 91 percent of this classification and virtually all the imports of manufactured blue and ball clay. Small tonnages of imports of blue and ball clays came from Canada and Germany. Imports of Gross Almerode clays (from United Kingdom) in 1949 totaled only 459 short tons. Exports, if any, are not separately published.

The mining and processing of ball clay in the United States were described.[5] Advantages of using ball clay and kaolin in dinnerware compositions were noted.[6]

FIRE CLAY

Fire clay sold or used in 1949 decreased 13 percent to 8,571,844 tons from the peak year 1948 (9,849,914 tons). This decline was due in part to the general slackening in industrial demand for refractories and in part to work stoppages in the coal and steel industries.

[5] Bell, Richard, Ball-Clay Mining in the United States: Ceram. Age, vol. 53, No. 4, 1948, pp. [illegible]; Am. Ceram. Soc. Jour., vol. 32, No. 4, Apr. 1, 1949, p. 115 (abs.).

[6] Cox, Paul E., Why Use More Than One Clay in a Body Mixture: Ceram. Age, vol. 53, No. 4, 1948, pp. 202–203; Am. Ceram. Soc. Jour., vol. 32, No. 4, Apr. 1, 1949, p. 109.

Refractories and heavy clay products were the major outlets for fire clay, totaling 4,811,099 and 3,430,723 tons, respectively, a combined total of 96 percent of the total tonnage. About 1 percent each was consumed in the manufacture of high-grade tile and in chemicals and the remainder in a wide variety of uses. Refractories decreased 20 percent in 1949 compared with 1948, but heavy clay products declined only 1 percent. The chief use of fire clay is in making fire brick and block, taking 3,754,420 tons in 1949. Several of the less important uses were larger in 1949 than in 1948—pottery and stoneware, rubber, linoleum, high-alumina brick, clay crucibles, and glass refractories.

In 1949 Ohio ranked first in order of output of fire clay, followed by Pennsylvania, Missouri, Indiana, Kentucky, California, and Illinois. These seven States produced 80 percent of the total. The

Fire clay, including stoneware clay[1] sold or used by producers in the United States, 1948–49, by States

State	Sold by producer		Used by producer		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948						
Alabama	130,023	$235,418	40,766	$111,108	170,789	$346,526
Arkansas	(2)	(2)	(2)	(2)	273,540	909,376
California	135,068	378,729	412,262	933,701	547,330	1,312,430
Colorado	114,036	234,150	52,453	134,776	166,489	368,926
Illinois	198,732	701,890	200,474	486,488	399,206	1,188,378
Indiana	206,249	347,515	111,848	239,198	318,097	586,713
Kentucky	95,778	486,288	420,391	1,724,054	516,169	2,210,342
Maryland	15,557	107,633	119,247	440,367	134,804	548,000
Missouri[3]	370,064	947,030	1,126,699	3,876,852	1,496,763	4,823,882
New Jersey	86,032	700,047	246,733	610,656	332,765	1,310,703
Ohio	794,732	1,979,751	1,991,777	4,578,905	2,786,509	6,558,656
Pennsylvania	338,096	1,106,561	1,533,591	6,196,592	1,871,687	7,303,153
Tennessee	(2)	(2)	(2)	(2)	30,148	174,695
Texas	(2)	(2)	(2)	(2)	259,128	590,420
Utah	(2)	(2)	(2)	(2)	26,363	76,279
Washington	22,955	32,464	59,145	109,668	82,100	142,132
West Virginia	(2)	(2)	(2)	(2)	314,084	756,627
Other States[4]	128,394	377,473	898,812	2,346,720	123,943	216,796
Total	2,635,716	7,634,949	7,214,198	21,789,085	9,849,914	29,424,034
1949						
Alabama	96,934	194,737	25,118	51,375	122,052	246,112
Arkansas	(2)	(2)	(2)	(2)	278,245	897,917
California	129,836	386,067	232,656	402,607	362,492	788,674
Colorado	116,594	253,572	58,387	167,772	174,981	421,344
Illinois	168,388	638,610	187,575	445,155	355,963	1,083,765
Indiana	257,930	371,011	121,747	285,818	379,677	656,829
Kentucky	67,151	357,627	306,486	1,369,429	373,637	1,727,056
Maryland	10,838	56,984	142,251	435,093	153,089	491,977
Missouri[3]	360,759	858,775	840,389	2,881,167	1,201,148	3,739,942
New Jersey	64,318	556,735	173,121	439,378	237,439	996,113
Ohio	628,320	1,691,381	1,877,986	4,480,032	2,506,306	6,171,413
Pennsylvania	267,467	874,790	1,396,097	5,441,406	1,663,564	6,316,196
Tennessee	(2)	(2)	(2)	(2)	41,732	205,770
Texas	3,062	12,289	240,311	524,855	243,373	537,144
Utah	7,600	23,900	24,385	67,599	31,985	91,499
Washington	12,449	15,360	72,867	152,264	85,316	167,624
West Virginia	(2)	(2)	(2)	(2)	239,373	586,237
Other States[4]	66,217	287,002	614,605	1,635,813	123,472	232,891
Total	2,257,863	6,578,740	6,313,981	18,779,763	8,571,844	25,358,503

[1] Includes stoneware clay as follows: 1948—143,701 tons, $321,062; 1949—103,417 tons, $224,113.
[2] Included with "Other States."
[3] Includes diaspore and burley clay as follows: 1948—diaspore, 52,255 tons, $565,163; burley, 38,393 tons, $295,[illegible]; 1949—diaspore, 25,259 tons, $308,885; burley, 32,432 tons, $204,850.
[4] Includes States indicated by footnote 2 above, and Alaska (1948 only), Delaware, Idaho, Iowa, Kansas, Massachusetts, Michigan (1949 only), Minnesota, Mississippi, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Carolina, and Virginia.

remainder was produced in 26 other States. Of the 17 principal producing States shown in the accompanying table, 7 (Arkansas, Colorado, Indiana, Maryland, Tennessee, Utah, and Washington) reported increases and 10 reported decreases.

Price quotations on fire clay do not appear in trade journals. However, average realizations per ton reported to the Bureau of Mines by producers indicated that the average value of fire clay sold in 1949 was $2.91 per ton, compared with $2.90 in 1948. The average value of all fire clay, including both sales and captive tonnage, was $2.96 in 1949 compared with $2.99 in 1948. Quotations on fire-clay products, which during 1948 had been raised three times, remained steady throughout 1949 and were reported by E&MJ Metal and Mineral Markets as follows: Missouri, Kentucky, and Pennsylvania fire-clay brick, first quality, $100 per thousand, and second quality, $80 per thousand; Ohio firebrick, intermediate grade, $74 per thousand, and second-grade, $66 per thousand.

Imports of fire clay are not shown separately in foreign trade statistics. Exports of fire clay in 1949 were 21 percent in tonnage and 18 percent in value less than in 1948, and totaled 80,736 short tons valued at $766,195. Canada took 85 percent of the total exports; Mexico 7 percent; and Chile 2 percent. The remainder (6 percent) comprised small tonnages to 42 destinations in Central and South America, Europe, Asia, and Africa.

Occurrence, chemical analyses, and ceramic tests of the diaspore, burley, flint, and plastic fire clays of Missouri were described [7] and differential thermal analyses published.[8] Utilization and composition of plastic refractories, ramming mixes, and castables were reported.[9]

BENTONITE

After an 11-year period of steadily increasing output, production of bentonite in 1949 decreased 6 percent in tonnage and 3 percent in value compared with 1948. Production and value, however, were the second highest on record. The smaller coal and steel outputs, due to lower general business activity as well as to the work stoppages, directly affected the sale of bentonite to foundries and resulted in a 22-percent drop in sales for use as foundry-sand bond.

As in 1948, bentonite used in the foundry and petroleum industries totaled 92 percent of the total tonnage—rotary-drilling mud accounting for 36 percent (313,083 tons); filtering and decolorizing oils, 35 percent (303,797 tons); and foundry-sand bond, 21 percent (178,867 tons). The remaining tonnage (71,496 tons) was consumed in a wide variety of purposes. Bentonite used for filtering and decolorizing oils rose 5 percent over 1948, and insecticides 19 percent. Nine States reported outputs of bentonite in 1949. Increases in tonnage were noted for Arizona and Utah and decreases for California, Mississippi, Montana, South Dakota, and Wyoming. Production was reported in Idaho for the first time. Trends in sales for principal uses are shown in an accompanying chart (fig. 2).

[7] McQueen, H. S., and Herold, Paul G., Geology of the Fire-Clay District of East Central Missouri: Missouri Geol. Survey Bull. 28, 1943, 250 pp.; Chem. Abs., vol. 38, 1944, p. 936; Am. Ceram. Soc. Jour., vol. 32, No. 4, Apr. 1, 1949, p. 117.

[8] Keller, W. D., and Westcott, J. F., Differential Thermal Analyses of Some Missouri Fire Clays: Am. Ceram. Soc. Jour., vol. 31, No. 4, Apr. 1, 1948, pp. 100–105.

[9] Schroeder, F. W., Specialties Solve Many Refractories Problems: Modern Power and Eng., vol. 43, No. 2, February 1949, pp. 53–55, 100. Same in Refractories Jour., October 1949 (No. 10), pp. [illegible].

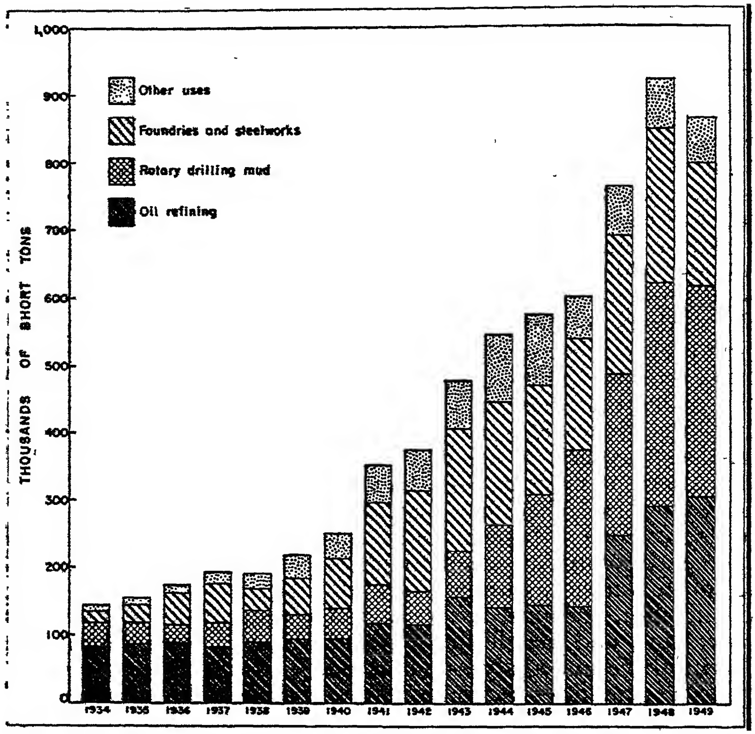

FIGURE 2.—Bentonite sold or used by domestic producers for specified uses, 1934–49.

Bentonite sold or used by producers in the United States, 1947–49, by States

State	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
California	5,328	$55,500	18,676	$101,450	(1)	(1)
South Dakota	186,450	2,070,659	156,701	1,702,430	137,376	$1,515,927
Texas	18,628	146,187	29,926	282,036	27,598	302,384
Wyoming	259,084	2,583,255	383,815	3,682,734	350,644	3,556,480
Other States [2]	294,399	1,093,985	332,442	1,367,658	351,625	1,563,961
Total	763,889	5,949,586	921,560	7,136,308	867,243	6,938,752

[1] Included with "Other States."
[2] Arizona, California (1949 only), Colorado (1948 only), Idaho (1949 only), Mississippi, Montana, Nevada (1948 only), and Utah.

The Wyoming-South Dakota area supplied 56 percent of the total bentonite in 1949 (Wyoming, 40 percent, and South Dakota, 16 percent) compared with 59 percent in 1948. Texas furnished 3 percent of total sales, the same as in 1948, and the remainder was produced in Arizona, California, Idaho, Mississippi, and Montana.

Wyoming bentonite in 1949 was quoted in E&MJ Metal and Mineral Markets at the same figures as in 1948—dried, crushed, in bulk, $8 per ton; and 200-mesh, pulverized, in 100-pound bags, $11. The average realization per ton as compiled from reports of producers to

the Bureau of Mines rose to $8 per ton in 1949 compared with $7.74 in 1948 and $7.79 in 1947.

Imports of bentonite in 1949 were very small and originated in Africa. Exports of bentonite are not shown separately in foreign trade statistics and are included under the blanket classification of "other clays or earth, not specifically provided for." It is understood, however, that some domestic producers export part of their production to widely distributed destinations throughout the world.

Numerous articles on bentonite were published during 1949. A description of open-pit strip mining methods in the recovery of bentonite in Arizona was published.[10] An account of the origin, occurrence, and current mining and processing practices of bentonite in the Black Hills region of South Dakota was presented.[11] The Wyo-Dak Chemical Co., Upton, Wyo., was reported to be building a new milling plant.[12] Detailed tests of white-firing bentonite in Fayette, Gonzales, and Karnes Counties, Tex., revealed commercial quantities of good-quality material.[13] Suggested uses also were given. Fluorescence of Wyoming bentonites was studied.[14]

A refractory lining made of ganister, silica flour, and bentonite was patented.[15] Use of bentonite in preparing pottery bodies to promote plasticity was said to improve the body mix.[16] The relationship of particle size of montmorillonite to its base-exchange capacity was studied and comparisons with kaolinite were presented.[17] Experiments at various temperatures indicated the efficiency of montmorillonite as a cracking catalyst.[18] The use of small quantities of bentonite mixed with hard wheat flour increased both volume and weight of the loaf.[19]

The bentonite industry in Manitoba;[20] the occurrence, mineralogy, and physical properties of Argentine bentonites;[21] and deposits and utilization of Australia's swelling and nonswelling bentonites[22] were described.

FULLER'S EARTH

The production of fuller's earth in 1949 declined 6 percent in quantity and 1 percent in value compared with 1948. The output (320,906 tons) was greater than the average for the 5-year period 1945–49 (317,435 tons) and was the fourth-largest year on record. Distri-

[10] Parker, John L., Clay Roundup in Arizona: Excavating Eng., vol. 43, No. 11, November 1949, pp. 17–19, 56.

[11] Harding, A. C., Bentonite Production in the Black Hills Area: Mines Mag., vol. 39, No. 4, April 1949, pp. 11–12, 15, 26, 32.

[12] Mining World, vol. 11, No. 6, May 1949, p. 68.

[13] Pence, Forrest K., Texas White-Firing Bentonite: Am. Inst. Min. and Met. Eng. Tech. Pub. 2504; Mining Eng., vol. 1, No. 1 (sec. 3), January 1949, pp. 27–32; Am. Ceram. Soc. Jour., vol. 32, No. 4, Apr. 1, 1949, p. 116 (abs.).

[14] Brown, B. W., Fluorescence Study of Wyoming Bentonite: Am. Mineralogist, vol. 34, No. 1–2, January–February, 1949, pp. 98–101; Am. Ceram. Soc. Jour., vol. 32, No. 9, Sept. 1, 1949, p. 217 (abs.).

[15] Cress, W. C., (assigned to Whiting Corp.), United States Patent 2,461,146, Feb. 8, 1949 (Feb. 5, 1945); Am. Ceram. Soc. Jour., vol. 32, No. 8, Aug. 1, 1949, p. 187 (abs.).

[16] Cox, Paul E., Preparing Pottery Bodies Rich in Bentonite: Ceram. Age, vol. 54, No. 3, September 1949, p. 182.

[17] Johnson, A. L., Surface Area and its Effect on Exchange Capacity of Montmorillonite: Am. Ceram. Soc. Jour., vol. 32, No. 6, June 1, 1949, pp. 210–214.

[18] Grenall, A., Montmorillonite Cracking Catalyst: Ind. Eng. Chem., vol. 40, 1948, pp. 2148–2151; British Abs., B-I-8, April 1949, p. 289.

[19] Esselbaugh, N. C., Effect of Bentonite on Loaf Volume and Weight of Hard and Soft Wheat Bread: Cereal Chem., vol. 25, 1948, pp. 280–285; British Abs., February 1949, p. 85.

[20] Canadian Mining and Metallurgical Bulletin, vol. 42, No. 441, January 1949, pp. 11–12.

[21] Bordas, A. F. (Argentinian Bentonites): Rev. Minera, Geol. y Mineral., vol. 14, 1943, pp. 3–60; Chem. Abs., vol. 38, 1944, p. 1187; Am. Ceram. Soc. Jour., vol. 32, No. 4, Apr. 1, 1949, p. 115.

[22] Lynch, Charles, La Bentonite d'Australie: Chim. et ind., vol. 61, No. 2, February 1949, p. 159, Same (in English): Rocks and Minerals, vol. 24, Nos. 5–6, May–June 1949, pp. 260–261; Am. Ceram. Soc. Jour., vol. 32, No. 6, June 1, 1949, p. 149 (abs.).

bution of production by major uses for 1940 to 1949 contrasted with the distribution pattern in 1930 is shown in the accompanying chart (fig. 3). Newer uses, such as insecticides and absorbents, have been responsible for the higher outputs in recent years.

Fuller's earth consumed in mineral-oil refining in 1949 totaled 151,353 tons, or 47 percent of the total output, compared with 57 percent in 1948. Absorbent uses accounted for 69,070 tons (22 percent of the total, the same ratio as in 1948); insecticides, 37,342 tons (12 percent of the total in 1949, compared with 5 percent in 1948); rotary-drilling mud, 30,411 tons (9 percent compared with 7 percent in 1948); and vegetable-oil refining, 19,806 tons (6 percent in 1949 compared with 7 percent in 1948). The remainder was used in other filtering and clarifying, binders, and other unspecified uses. Increases in tonnage in 1949 over 1948 were registered only by rotary-drilling mud and insecticides.

States increasing output over 1948 were California, Mississippi, Tennessee, and Texas; the others reported decreases. Florida and Georgia combined accounted for 57 percent of the total tonnage and Texas 31 percent.

Fuller's earth sold or used by producers in the United States, 1947–49, by States

State	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Florida and Georgia	168,557	$2,699,660	188,014	$3,224,169	181,993	$3,194,551
Illinois	37,740	388,955	37,942	410,678	9,104	118,647
Texas	102,901	1,199,726	92,310	1,162,336	100,745	1,242,558
Other States [1]	19,870	372,273	23,815	476,668	29,064	643,886
Total	329,068	4,660,614	342,081	5,273,851	320,906	5,199,642

[1] Includes California, Mississippi, Nevada, Tennessee, and Utah.

As reported in E&MJ Metal and Mineral Markets, no change occurred in quotations on Georgia and Florida fuller's earth in 1949 compared with 1948, and prices were quoted as follows: 30- to 60-mesh, $14.50 per short ton; 14- to 30-mesh, $14; 200-mesh up, $10; and 100-mesh up, $7. Average value of fuller's earth sold or used as reported to the Bureau of Mines by producers was $16.20 in 1949, compared with $15.42 in 1948 and $14.16 in 1947.

Imports of fuller's earth in 1949 totaled only 389 short tons, largely from United Kingdom, with small amounts from Canada and Australia. Exports are not given separately in official foreign statistics. Reports from the producers to the Bureau of Mines, however, indicated exports of approximately 12,100 short tons in 1949, compared with 10,600 tons in 1948. Destinations reported included Canada, Central and South America, Netherlands West Indies, several European nations, Bahrein Island, Saudi Arabia, and the Philippines.

A new percolation type of fuller's earth was introduced.[23] A process for revivifying spent absorbent earths by burning out carbonaceous impurities, using a multistage process, was patented.[24] Comparisons

[23] Chemical and Engineering News, vol. 27, No. 8, Feb. 21, 1949, p. 553.
[24] Simpson, T. P., Handling a Contact Mass (assigned to Socony-Vacuum Oil Co., Inc.): United States Patent 2,[illegible], Feb. 24, 1948 (appl. filed June 17, 1942).

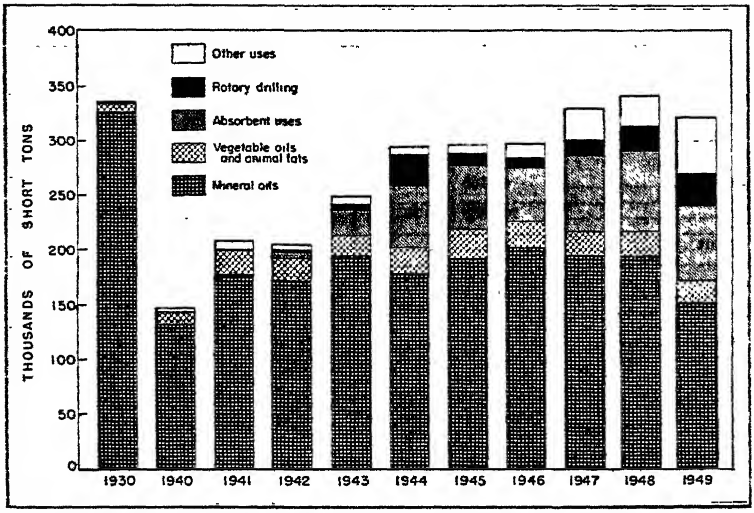

FIGURE 3.—Fuller's earth sold or used by producers for specified uses, 1930 and 1940–49.

of natural and treated absorbent earths from the United States and five other countries were given in a recent French publication.[25]

MISCELLANEOUS CLAYS

This section includes statistics for clays and shales (large tonnages of which are used in the manufacture of heavy clay products and portland cement) other than those discussed in the preceding pages. With these clays are grouped small tonnages of slip clay, oil-well drilling mud, pottery clay, and other clays that cannot be clearly identified with one of the types given separate treatment in this chapter.

Production of miscellaneous clays in 1949 continued at a high level, with a 4-percent drop in tonnage compared with 1948. In 1949, 69 percent of the total miscellaneous clays was used in the manufacture of heavy clay products and 28 percent in cement. Tonnage consumed in heavy clay products was 7 percent less than in 1948 and quantities used in cement manufacture rose 4 percent.

For the past 3 years (1947–49), 96 percent of the clay and shale for which figures are given in this section was captive tonnage—mined by the clay-products companies near their processing plant and first marketed as brick, cement, tile, or other finished products. The average value of the miscellaneous clay sold as raw or prepared clay in 1949 was $1.66 compared with $1.89 in 1948 and $1.99 in 1947. Some of the special types of clay included under the "miscellaneous" clay classification, however, sold for much higher values. The value of the captive tonnage was computed from individual estimates that generally are $1 or less per ton.

Miscellaneous clays, which include the so-called common or surface clays and shales, are widely distributed and producing deposits

[25] Ackerman, A., [The Absorbent Earth Industry]: Chim. et ind., vol. 61, No. 1, January 1949, pp. 28-37; Am. Ceram. Soc. Jour. vol. 32, No. 4, Apr. 1, 1949, p. 123.

Miscellaneous clays, including shale and slip clay, sold or used by producers in the United States, 1948–49, by States

State	Sold by producers [1]		Used by producers [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948						
Alabama	48,156	$44,011	1,027,634	$738,384	1,075,790	$782,395
Arkansas			193,913	186,984	193,913	186,984
California	240,950	765,691	1,841,359	1,281,220	2,082,309	2,046,911
Colorado			292,287	238,392	292,287	238,392
Connecticut			314,569	230,026	314,569	230,026
Georgia			1,081,225	829,412	1,081,225	829,412
Illinois	43,990	49,542	2,043,436	1,809,605	2,087,426	1,859,147
Indiana	98,129	82,071	793,799	617,267	891,928	699,338
Iowa	9,680	88,483	860,170	683,413	869,850	771,896
Kansas			583,338	438,672	583,338	438,672
Kentucky			182,493	143,590	182,493	143,590
Louisiana			248,870	194,956	248,870	194,956
Maine			26,906	24,552	26,906	24,552
Maryland			447,247	324,389	447,247	324,389
Massachusetts	(3)	(3)	(3)	(3)	131,609	103,783
Michigan	300,224	283,422	1,007,946	702,318	1,308,170	985,740
Minnesota	(3)	(3)	(3)	(3)	112,672	97,187
Missouri	(3)	(3)	(3)	(3)	638,784	485,246
Montana			29,603	28,309	29,603	28,309
Nebraska	(3)	(3)	(3)	(3)	158,079	127,766
New Hampshire			25,262	18,960	25,262	18,960
New Jersey			265,318	235,028	265,318	235,028
New Mexico	(3)	(3)	(3)	(3)	46,983	50,604
New York	(3)	(3)	(3)	(3)	1,465,305	1,129,484
North Carolina	(3)	(3)	(3)	(3)	1,179,437	961,221
Ohio	(3)	(3)	(3)	(3)	2,177,072	1,699,165
Oklahoma			510,316	389,903	510,316	389,903
Oregon	(3)	(3)	(3)	(3)	165,931	117,740
Pennsylvania	13,589	21,036	1,673,730	1,339,961	1,687,319	1,360,997
South Carolina			426,039	364,549	426,039	364,549
Tennessee	(3)	(3)	(3)	(3)	790,752	625,342
Texas	38,665	321,466	1,262,525	987,082	1,301,190	1,308,548
Utah			138,311	169,580	138,311	169,580
Washington	(3)	(3)	(3)	(3)	209,266	152,420
West Virginia			276,395	220,049	276,395	220,049
Wisconsin	(3)	(3)	(3)	(3)	155,062	113,803
Wyoming			16,821	9,640	16,821	9,640
Undistributed [4]	172,251	164,865	8,211,453	6,387,866	1,152,752	888,970
Total	965,634	1,820,587	23,780,965	18,594,107	24,746,599	20,414,694
1949						
Alabama	(3)	(3)	(3)	(3)	1,048,599	760,845
Arkansas			175,758	182,687	175,758	182,687
California	216,802	664,659	1,627,940	1,213,000	1,844,742	1,877,659
Colorado			294,347	238,950	294,347	238,950
Connecticut			289,090	216,829	289,090	216,829
Georgia	(3)	(3)	(3)	(3)	929,188	753,761
Illinois	(3)	(3)	(3)	(3)	1,826,851	1,669,650
Indiana	112,388	84,353	803,674	660,612	916,062	744,965
Iowa	5,099	80,677	813,293	662,357	818,392	743,034
Kansas	(3)	(3)	(3)	(3)	600,216	455,181
Kentucky			161,463	125,551	161,463	125,551
Louisiana	(3)	(3)	(3)	(3)	249,912	193,501
Maine			27,918	24,568	27,918	24,568
Maryland	(3)	(3)	(3)	(3)	489,009	367,211
Massachusetts	(3)	(3)	(3)	(3)	150,530	117,570
Michigan	(3)	(3)	(3)	(3)	1,358,622	1,007,740
Minnesota	(3)	(3)	(3)	(3)	113,960	97,250
Mississippi	(3)	(3)	(3)	(3)	281,763	252,382
Missouri	(3)	(3)	(3)	(3)	618,914	473,643
Montana			40,114	40,514	40,114	40,514
Nebraska			132,439	112,699	132,439	112,699
New Hampshire			26,392	19,795	26,392	19,795
New Jersey			295,800	270,813	295,800	270,813
New Mexico	(3)	(3)	(3)	(3)	93,412	58,957
New York	(3)	(3)	(3)	(3)	1,285,027	974,208
North Carolina	(3)	(3)	(3)	(3)	1,161,649	964,749
Ohio	94,182	73,865	1,909,643	1,452,214	2,003,825	1,526,079
Oklahoma	(3)	(3)	(3)	(3)	490,199	374,179
Oregon			159,068	122,877	159,068	122,877
Pennsylvania	65,354	106,646	1,529,375	1,202,261	1,594,729	1,308,907
South Carolina	(3)	(3)	(3)	(3)	423,902	318,601
Tennessee	(3)	(3)	(3)	(3)	716,230	507,121

See footnotes at end of table.

Miscellaneous clays, including shale and slip clay, sold or used by producers in the United States, 1948–49, by States—Continued

State	Sold by producers [1]		Used by producers [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1949						
Texas	36,587	$202,628	1,321,873	$995,435	1,358,460	$1,198,063
Utah			204,896	428,071	204,896	428,071
Washington	(3)	(3)	(3)	(3)	193,021	134,442
West Virginia			315,151	230,594	315,151	230,594
Wisconsin	(3)	(3)	(3)	(3)	159,360	116,215
Wyoming			19,138	10,564	19,138	10,564
Undistributed [5]	498,592	493,284	12,549,189	9,706,065	867,467	602,143
Total	1,029,004	1,706,112	22,696,561	17,916,456	23,725,565	19,622,568

[1] Includes slip clay as follows: 1948—Michigan and New York; 1949—Indiana, Michigan, and New York; figures cannot be shown separately. Purchases by portland cement companies of common clay and shale: 1948—472,556 tons, estimated at $362,853; 1949—559,682 tons, estimated at $494,147.
[2] Includes the following: Common clay and shale used by portland cement companies: 1948—5,888,962 tons, estimated at $3,761,284; 1949—6,058,502 tons, estimated at $3,866,210.
[3] Included under "Undistributed."
[4] Figures include Alaska, Arizona, Delaware, District of Columbia, Florida, Idaho, Mississippi, North Dakota, Puerto Rico, South Dakota, Vermont, Virginia, and States indicated by footnote 3.
[5] Figures include Arizona, Delaware, District of Columbia, Florida, Idaho, Nevada, North Dakota, South Dakota, Vermont, Virginia, and States indicated by footnote 3.

occur in all States (except Rhode Island). States reporting a production of over 1 million tons in 1949, in order of output, were: Ohio, California, Illinois, Pennsylvania, Texas, Michigan, New York, North Carolina, and Alabama. Of the States for which data are shown in the accompanying table, 19 reported increases in output, and 18 reported decreases in 1949 compared with 1948.

HEAVY CLAY PRODUCTS

The total value of shipments of the principal structural clay products in 1949 declined to $262,000,000 compared with $268,000,000 in 1948—a decrease of 2 percent, according to the Bureau of the Census. Shipments of all classes of products shown except hollow facing tile and unglazed structural tile were smaller in 1949 than in 1948. Shipments of unglazed brick and floor and wall tile declined 8 and 9 percent, respectively, compared with 1948, and vitrified-clay sewer-pipe and drain-tile shipments each decreased 6 percent. Unglazed structural

Shipments of principal structural clay products in the United States, 1947–49 [1]

Product and unit of quantity	1947		1948		1949	
	Quantity	Value	Quantity	Value	Quantity	Value
Unglazed brick (common and face) .... M stand. brick	4,930,717	$106,079,000	5,708,838	$134,445,000	5,251,683	$129,179,000
Unglazed structural tile .... short tons	1,229,885	12,427,000	1,250,904	13,364,000	1,259,445	14,960,000
Vitrified clay sewer pipe .... do	1,324,793	40,302,000	1,432,512	46,731,000	1,349,598	44,641,000
Drain tile .... do	714,632	9,626,000	734,331	10,866,000	688,616	11,084,000
Hollow facing tile, glazed and unglazed .... M brick equiv	301,208	13,789,000	321,841	16,029,000	357,461	18,717,000
Glazed and unglazed floor and wall tile and accessories, including quarry tile .... M square feet	88,047	36,781,000	102,251	46,646,000	93,115	43,905,000

[1] Compiled from information furnished by the Bureau of the Census, U. S. Department of Commerce.

Production and shipments of refractories in the United States, by kind, 1948–49

[Bureau of the Census]

Product	Unit of quantity	1948			1949		
		Production (quantity)	Shipments		Production (quantity)	Shipments	
			Quantity	Value (in thousands of dollars)		Quantity	Value (in thousands of dollars)
Clay refractories:							
Fire-clay brick, standard and special shapes, except superduty.	1,000 9-in. equiv.	655,471	649,745	58,948	523,623	514,378	48,819
Superduty fire-clay brick, standard and special shapes.	do	66,515	62,025	8,321	57,353	51,586	7,680
High-alumina brick, standard and special shapes (50 percent Al_2O_3 and over, except fused alumina and mullite).	do	22,498	20,708	4,896	16,459	16,346	4,392
Insulating firebrick, standard and special shapes.	do	43,668	36,804	5,997	29,239	33,315	5,840
Ladle brick	do	185,497	184,052	9,526	164,089	159,790	8,557
Hot-top refractories	do	52,345	53,284	4,760	34,560	34,284	3,261
Sleeves, nozzles, runner brick and tuyères.	do	51,659	51,845	5,662	40,310	39,189	4,802
Glass-house pots, tank blocks, upper structure, and floaters.	Short tons	25,305	25,505	3,404	17,218	17,564	2,539
High-temperature bonding mortars.	do	68,825	68,254	4,675	54,462	53,829	4,146
Plastic refractories (including wet and dry ramming mixtures).	do	110,345	109,063	4,250	79,386	77,080	3,701
Cast and castables (hydraulic setting).	do	52,852	51,754	3,272	47,437	47,675	3,430
Ground crude fire-clay and high-alumina material.	do	350,378	350,432	3,191	329,470	327,864	2,943
Other clay refractories				2,457			2,034
Total clay refractories				119,359			102,144
Nonclay refractories:							
Silica brick, standard and special shapes.	1,000 9-in. equiv.	321,443	318,203	34,118	266,596	261,719	30,320
Magnesite and magnesite-chrome (magnesite predominating) brick, standard and special shapes.	do	24,462	24,556	11,717	18,508	18,650	9,279
Chrome and chrome-magnesite (chrome predominating) brick, standard and special shapes.	do	41,706	41,077	16,073	35,847	34,777	14,312
Graphite and other carbon crucibles and retorts.	Short tons	11,535	11,431	5,384	7,180	7,328	3,628
Other graphite and carbon refractories.	do	1,217	1,157	445	846	814	298
Silicon carbide				14,704			6,116
Mullite and kyanite							2,454
Sillimanite							356
Fused alumina and bauxite							2,530
Zirconia, forsterite, fused magnesia, pyrophyllite, and other nonclay shapes.							1,693
High temperature bonding mortars.	Short tons	36,851	36,907	3,697	30,954	30,820	3,332
Plastic refractories (including wet and dry ramming mixtures).	do	88,539	88,328	5,630	72,339	72,015	4,934
Other nonclay refractory materials, sold in lump or ground form (including ground silica and nonclay cast and castables).				2,616			2,875
Total nonclay refractories [1]				94,384			82,027
Grand total refractories [1]				213,743			184,171

[1] Data for dead-burned magnesia or magnesite excluded to avoid duplication in other refractory products covered in this table (such as magnesite brick and shapes). Quantity and value of shipments of dead-burned magnesia or magnesite totaled 305,000 tons valued at $11,421,000 in 1948, and 218,000 tons valued at $8,606,000 in 1949.

tile, however, was slightly above 1948, while hollow facing tile in 1949 rose 11 percent above 1948.

After the reconversion period following World War II, production and shipments of refractories were stimulated by the general business expansion and the augmented industrial production required to satisfy pent-up civilian and industrial needs. The increased refractory output continued through 1948 and the early part of 1949. The coal and steel stoppages then resulted in curtailed production and were the chief factors in a 14-percent drop in value of shipments of clay refractories in 1949 as against the 1948 total. The value of shipments of fire bricks (except superduty) was $48,819,000, 17 percent under 1948; of superduty fire-clay brick, 8 percent under 1948; and of ladle brick, 10 percent under 1948.

TECHNOLOGY

The year was marked by active research into the use of clays in structural products, including lightweight aggregate. This emphasis on long-term research resulted in formation of the Structural Clay Products Research Foundation to foster and carry forward the $1,250,000 5-year investigation into all phases of the brick and tile industry.[26] A new research agency, the Brick and Tile Research Institute, was organized to advance the interests of the brick and tile manufacture in the Southeast.[27]

The use of common clays in making lightweight aggregates, utilizing their bloating characteristics, is increasing, and methods and developments were described.[28]

A brief yet comprehensive survey of the whole field of lightweight aggregates was published.[29] The addition of soda ash in controlled amounts is claimed to improve the working properties of a clay mix.[30] The nonceramic uses of clays were discussed briefly.[31] An investigation of the fire-resistant qualities of structural clay partitions [32] was undertaken. A detailed discussion of laboratory procedure and methods of analysis of clays was published.[33] A new foundry molding sand treatment method was reported.[34]

[26] Brick and Clay Record, vol. 115, No. 4, October 1949, p. 52; vol. 114, No. 2, February 1949, p. 45.
[27] Brick and Clay Record, vol. 114, No. 5, May 1949, p. 36.

Plummer, Norman, and Hladik, William B., Manufacture of Ceramic Railroad Ballast and Construction Aggregates from Kansas Clays and Silts: Kansas Geol. Survey Bull. 76, pt. 4, June 15, 1948, pp. 53–112; Am. Ceram. Soc. Jour., vol. 32, No. 3, Mar. 1, 1949, p. 90 (abs.)

Minsk, L. David, Producing Aggregate from Expanded Clay by Sintering Process: Rock Products, vol. 52, No. 11, November 1949, pp. 105–107, 116.

[29] Ralston, Oliver C., and Conley, John E., Lightweight Aggregate for Concretes: National Ready Mixed Concrete Assoc., Misc. Pub. 23, 1949, 14 pp.

[30] Brick and Clay Record, vol. 115, No. 6, December 1949, p. 50.

[31] Phelps, G. W., Nonceramic Uses for Clay: Ceram. Age, vol. 53, No. 1, 1949, pp. 11–12, 40.

[32] National Bureau of Standards, Building Materials and Structures Report BMS–113, Fire Resistance of Structural Clay Tile Partitions, 1949; Ceram. Age, vol. 53, No. 4, April 1949, p. 220.

[33] Shell, Haskiel R., Chemical Analysis of Clay: Bureau of Mines Rept. of Investigations 4420, 1949, 36 pp.

[34] Turner, W. A., Chemically Coated Sand; A New Binding and Refractory Process for Foundries: Iron and Steel, vol. 21, No. 12, 1948, pp. 483–484; Am. Ceram. Soc. Jour., vol. 32, No. 7, July 1949, p. 177.

Publications were issued describing clay resources of southern Arkansas,[35] New York,[36] Ohio,[37] Lawrence County, Ind.,[38] Pennsylvania,[39] and Fergus County, Mont.[40]

An extensive compilation of occurrences in the United States of kaolin, montmorillonite, bentonite, illite, attapulgite, and pyrophyllite [41] and a glossary of clay mineral names also were published.[42]

A number of articles appeared on fuels in the ceramic industries.[43]

The International Geological Congress meeting in London in 1948 sponsored the formation of an International Committee to correlate studies of clays, facilitate contact between specialists in this field, and interchange information.[44]

A discussion of firing tests on Philippine refractory clays and their utilization was published.[45] Papers on clays and shales in France,[46] Austria,[47] and western Siberia,[48] Saskatchewan,[49] Australia,[50] United Kingdom,[51] and India [52] were issued. The use of an extremely finely ground Canadian clay from British Columbia in pharmaceutical and cosmetic preparations was reported.[53] Thermal analyses of certain Japanese clays were made.[54]

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[44] Chemical and Engineering News, vol. 27, No. 21, May 23, 1949, p. 1536.

Chemical and Engineering News, vol 27, No. 2, Jan. 10, 1949, p 100.

[45] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 2, August 1949, pp. 25–26.

[46] Larcheveque, I. M. [Shales, Clays and Kaolins in France]: Ind. ceram., No. 385, 1948, p. 75; British Ceram. Abs., 1948, p. 339; British Abs., March 1949, p. 206.

Charrin, V., [Refractory Clay Deposits in the Paris Basin]: Génie civil, vol. 126, No. 4, 1949, pp. 68–69; Am. Ceram. Soc. Jour., vol. 32, No. 6, June 1, 1949, p. 149 (abs.).

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Coal—Bituminous and Lignite [1]

By W. H. Young, R. L. Anderson, and E. M. Hall

SURVEY OF THE BITUMINOUS-COAL AND LIGNITE INDUSTRY IN 1949

THE production of soft coal in 1949—an estimated output of 435,000,000 tons [2]—decreased 27 percent from the 599,518,229 tons produced in 1948. Decreased production was due to work stoppages, reduced exports, and diminished domestic demand. According to the Bureau of Labor Statistics, there were 421 strikes in soft-coal mines in 1949, with 1,130,000 workers involved and 16,700,000 man-days lost (an average of 15 days per man on strike).

Production.—Production was high during the first 6 months of 1949, generally exceeding 11,000,000 tons per week, except during strikes. During the last 6 months output averaged close to the 7,000,000-tons-per-week level.

Consumption.—All classes of consumers, except retail-dealer deliveries, used less coal in 1949 than in 1948. There was only a slight increase for retail-dealer deliveries. The total consumption in 1949 was approximately 74,000,000 tons less than in 1948. Table 5 shows trends in consumption for the major classes of consumers.

Changes in Stocks.—The reserve supply of bituminous coal and lignite in the hands of industrial consumers and retail coalyards decreased from 69,373,000 tons at the beginning of 1949 to 45,111,000 tons at the close. The days' supply of stocks decreased from 46 to 32. Stocks on the upper Lake docks decreased 4,026,981 tons from January 1 to December 31, 1949.

Mechanization.—The quantity of coal loaded mechanically at underground mines in the United States was less in 1949 than in 1948. However, the percentage mechanically loaded increased from 64 percent of the total underground output in 1948 to 67 percent in 1949. Sales of underground loading equipment, in terms of capacity, were less in 1949 than in any year since 1935.

Mechanical Cleaning.—The total capacity of mechanical-cleaning equipment sold for use at bituminous-coal mines in 1949 was estimated at 13,300 tons of cleaned coal per hour, a decrease of 25 percent from the previous year.

[1] Data for 1949 are preliminary; final figures will be issued in a Mineral Market Report about November 1950. Data for 1948 are final.

[2] Throughout this chapter, "tons" refers to net tons of 2,000 pounds, except that the world table is in metric tons of about 2,205 pounds.

Trend of Employment.—The average number of men working daily at bituminous-coal and lignite mines in 1949 decreased to 375,000 from 441,631 in 1948.

Index to Capacity.—As it is not possible for all mines to operate every working day in the year, a conservative figure of 280 days for calculating potential capacity was suggested some years ago by the coal committee of the American Institute of Mining and Metallurgical Engineers. (See Minerals Yearbook, 1935, pp. 631–632.) The average output per day worked in 1949 was 2,416,667 tons, which (if applied to 280 days) gives an annual potential output of 677,000,000 tons, compared with the actual production of 435,000,000 tons.

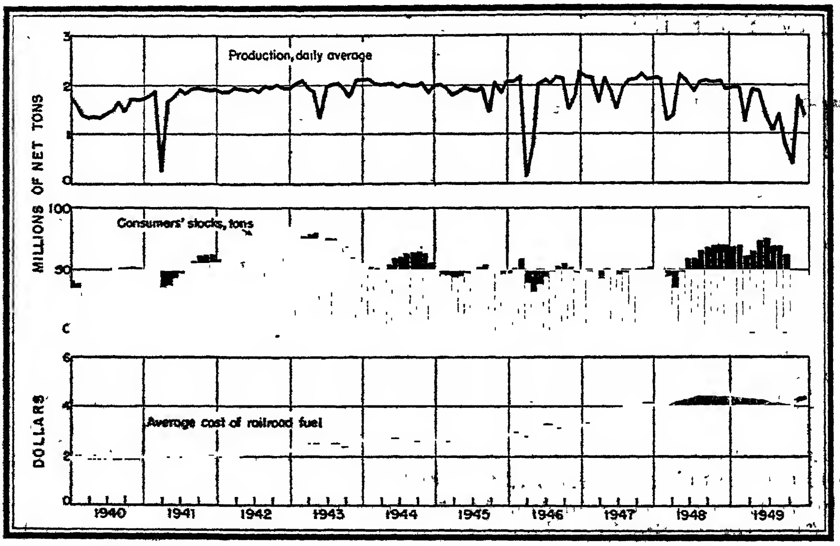

FIGURE 1.—Trends of production, stocks, and prices of bituminous coal and lignite in the United States, 1940–49.

Trends of Fuel Efficiency.—Since 1942 there has been no definite trend in fuel efficiency for the various consuming industries. During 1949 electric public-utility power plants attained increased fuel efficiency.

Competition With Oil and Gas.—Soon after the war, increased competition among the fuels developed, with numerous reports of conversion from coal to fuel oil and gas.

Electric-power utilities consumed 16 percent less bituminous coal, 56 percent more fuel oil, and 15 percent more gas in 1949 than in 1948.

Class I railroads decreased their consumption of coal 28 percent in 1949 and their purchases of fuel oil and Diesel oil 16 percent from 1948 purchases.

The manufacture of domestic coal-burning equipment is reflected in statistics published by the Bureau of the Census. Factory sales of domestic stokers for burning bituminous coal decreased from 61,359 in 1948 to 21,527 in 1949. Shipments of domestic oil burners, boiler-burner units, and furnace-burner units increased from 392,625 (revised figure) in 1948 to 567,515 in 1949.

FIGURE 2.—Production of bituminous coal and lignite in the United States, by weeks, 1948–49.

SOURCES OF DATA

Bituminous-coal- and lignite-production statistics for 1949 are preliminary estimates based upon (1) weekly or monthly reports of railroad carloadings of coal and beehive coke by all the important carriers, (2) shipments by river as reported by the United States Army Engineers, (3) direct reports from a number of mining companies, and (4) monthly production statements compiled by certain local operators' associations and State mine departments. In the estimates for 1949, allowance has been made for commercial truck shipments, local sales and colliery fuel, and small trucking or wagon mines producing 1,000 tons a year or more.

Data for 1948 are final and based upon detailed annual reports of production and mine operation furnished by the producers. As in previous years, all but a small percentage of the output was covered by the reports submitted. For the remaining output not directly reported—consisting chiefly of small mines—it has been possible to obtain reasonably accurate data from the records of the State mine departments, which have statutory authority to require such reports, or, in a few instances, from railroad carloadings.

In accordance with the practice followed by the Bureau of Mines in previous years, the statistics in this report relate to mines having an output of 1,000 tons a year or more and do not attempt to include many small mines producing less than 1,000 tons a year.

These data include all coal except Pennsylvania anthracite.

SALIENT STATISTICS

TABLE 1.—Salient statistics of the bituminous-coal and lignite industry in the United States, 1948–49

[All tonnage figures represent net tons]

	1948	1949 (preliminary)	Change in 1949
			Percent
Production	599,518,229	435,000,000	−27.4
Consumption	519,909,000	445,732,000	−14.3
Stocks at end of year:			
Industrial consumers and retail yards	69,373,000	45,111,000	−35.0
Stocks on upper Lake docks	7,288,977	3,261,996	−55.2
Imports and exports: [1]			
Imports	291,337	314,980	+8.1
Exports	45,930,133	27,842,056	−39.4
Price indicators (average per net ton):			*Dollars*
Average cost of railroad fuel purchased, f. o. b. mines [2]	$4.34	$4.36	+0.02
Average cost of coking coal at merchant coke ovens [3]	$8.74	$9.00	+.26
Average retail price [4]	$15.40	$15.83	+.43
Average railroad freight charge per net ton [5]	$2.74	$2.95	+.21
Average value of production, f. o. b. mines [6]	$4.99	$4.85	−.14
Underground loading machinery sold: [7]			*Percent*
Mobile loading machines (number)	723	286	−60.4
Scrapers (number)	17	8	−52.9
Conveyors, including those equipped with duckbills (units)	1,025	394	−61.6
"Mother" conveyors (units)	230	116	−49.6
Surface stripping	139,505,920	99,000,000	−29.0
Mechanically loaded underground	295,806,285	226,000,000	−23.6
Mechanically cleaned	180,883,323	137,000,000	−24.3
Number of mines [8]	9,079	9,000	−.9
Average number of days worked [8]	217	180	−17.1
Average number of men working daily [8]	441,631	375,000	−15.1
Production per man per day [8]	6.26	6.44	+2.9
Fuel efficiency indicator:			
Pounds of coal per kilowatt-hour at electric power plants [9]	1.30	1.25	−3.8

[1] U. S. Department of Commerce. Exports for 1948 are revised.
[2] Interstate Commerce Commission (class I steam railways, including class I switching and terminal companies). Excludes freight charges.
[3] As reported by coke operators.
[4] Bureau of Labor Statistics, U. S. Department of Labor.
[5] Average receipts per net ton of revenue bituminous coal and lignite originated, as reported by the Interstate Commerce Commission.
[6] Average gross realization, selling cost not deducted.
[7] Young, W. H., and Anderson, R. L., Sales of Mechanical Loading and Cleaning Equipment: Coal Age, February 1950, pp. 81–83; Min. Cong. Jour., February 1950, pp. 100–103; Mechanization, February 1950, pp. 56–58.
[8] Based upon reports of mine operators producing 1,000 tons and over. The number of men working represents man-days of labor divided by days the tipples operated.
[9] Federal Power Commission.

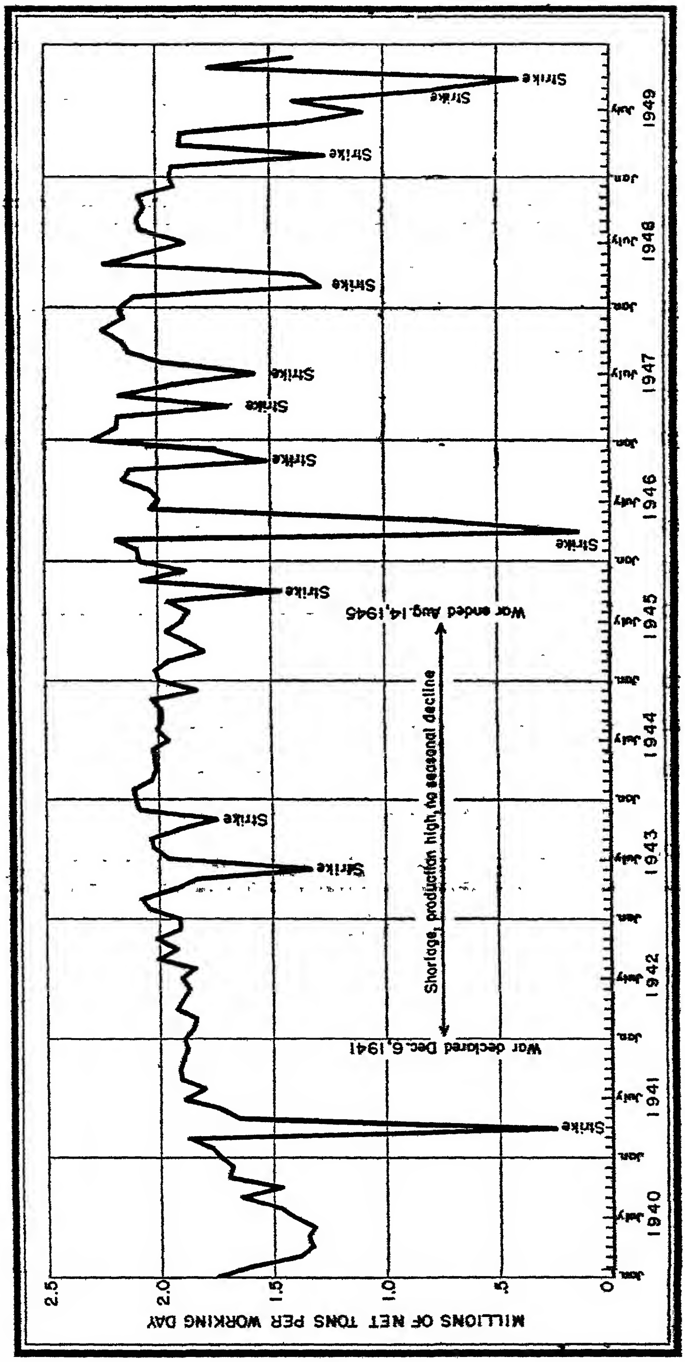

FIGURE 3.—Average production of bituminous coal and lignite in the United States per working day in each month, 1940–49.

PRODUCTION BY WEEKS AND MONTHS

The following tables summarize the preliminary statistics of weekly and monthly production of bituminous coal and lignite in 1949. The estimates given are based upon the latest information available and differ in some instances from the current figures published in the Weekly Coal Reports.

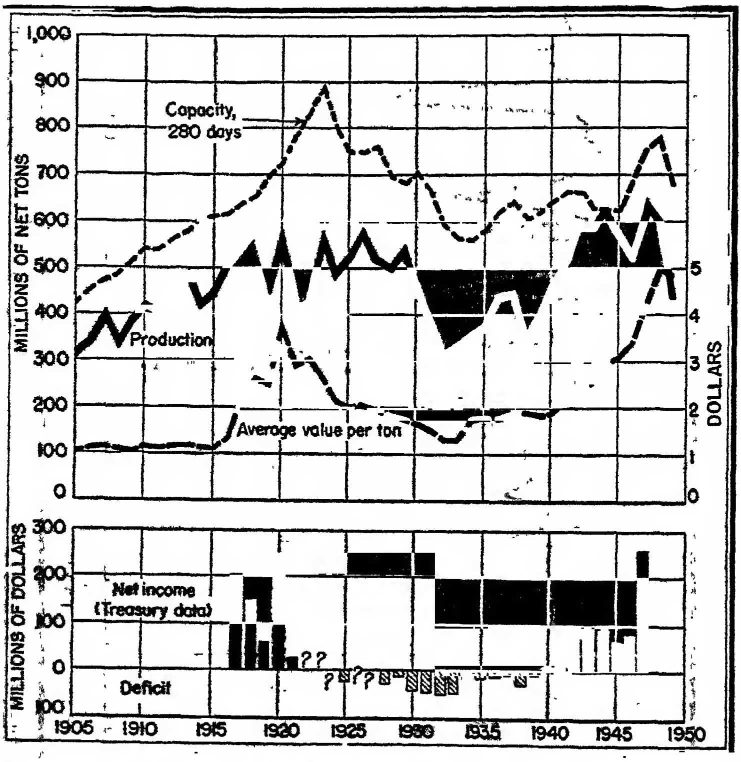

FIGURE 4.—Trends of bituminous-coal and lignite production, realization, mine capacity, and net income or deficit in the United States, 1905–49.

TABLE 2.—Estimated weekly production of bituminous coal and lignite in the United States in 1949

Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)	Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 1	[1] 75,000	[1] 0.1	[2] 1,770,000	July 16	6,906,000	6	1,151,000
Jan. 8	11,966,000	6	1,994,000	July 23	7,278,000	6	1,213,000
Jan. 15	12,190,000	6	2,032,000	July 30	7,653,000	6	1,276,000
Jan. 22	11,862,000	6	1,977,000	Aug. 6	7,522,000	6	1,254,000
Jan. 29	10,842,000	6	1,807,000	Aug. 13	7,968,000	6	1,328,000
Feb. 5	11,851,000	6	1,975,000	Aug. 20	7,524,000	6	1,254,000
Feb. 12	11,926,000	6	1,988,000	Aug. 27	7,881,000	6	1,314,000
Feb. 19	11,307,000	6	1,885,000	Sept. 3	8,075,000	6	1,346,000
Feb. 26	11,324,000	6	1,887,000	Sept. 10	6,155,000	5	1,231,000
Mar. 5	10,611,000	6	1,769,000	Sept. 17	8,695,000	6	1,449,000
Mar. 12	10,682,000	6	1,780,000	Sept. 24	1,984,000	6	331,000
Mar. 19	2,986,000	6	498,000	Oct. 1	1,784,000	6	297,000
Mar. 26	2,428,000	6	405,000	Oct. 8	2,142,000	6	357,000
Apr. 2	9,933,000	5	1,987,000	Oct. 15	2,316,000	6	386,000
Apr. 9	11,453,000	6	1,909,000	Oct. 22	2,471,000	6	412,000
Apr. 16	11,623,000	6	1,937,000	Oct. 29	2,707,000	6	451,000
Apr. 23	11,516,000	6	1,919,000	Nov. 5	2,679,000	6	447,000
Apr. 30	11,727,000	6	1,955,000	Nov. 12	7,183,000	6	1,197,000
May 7	11,284,000	6	1,881,000	Nov. 19	14,472,000	6	2,412,000
May 14	11,141,000	6	1,857,000	Nov. 26	12,937,000	5.3	2,441,000
May 21	11,214,000	6	1,869,000	Dec. 3	9,467,000	6	1,578,000
May 28	11,369,000	6	1,895,000	Dec. 10	9,526,000	6	1,588,000
June 4	10,089,000	5.4	1,868,000	Dec. 17	8,977,000	6	1,496,000
June 11	13,069,000	6	2,178,000	Dec. 24	9,317,000	6	1,553,000
June 18	2,190,000	6	365,000	Dec. 31	6,574,000	5	1,315,000
June 25	11,934,000	6	1,989,000				
July 2	1,300,000	6	217,000	Total	435,000,000	306.8	1,418,000
July 9	4,913,000	5	983,000				

[1] Figures represent output and number of working days in that part of the week included in calendar year shown. Total production for the week ended Jan. 1, 1949, was 9,029,000 net tons.
[2] Average daily output for the entire week and not for working days in the calendar year shown.

TABLE 3.—Estimated monthly production of bituminous coal and lignite in 1949, by States, in thousands of net tons

[Figures based principally on railroad carloadings and river shipments of coal and beehive coke. Allowance is made for all mines producing 1,000 tons or over per year]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	1,530	1,400	951	1,496	1,523	954	692	1,088	510	105	1,133	1,038	12,420
Alaska	31	32	38	36	40	41	23	32	25	89	58	60	455
Arkansas	138	144	118	65	53	56	42	86	74	116	173	115	1,180
Colorado	662	620	465	285	277	228	140	289	236	423	535	380	4,540
Illinois	5,741	5,737	3,944	4,602	4,466	3,692	3,111	3,806	2,154	1,547	5,193	3,808	47,800
Indiana	2,208	2,132	1,292	1,956	1,558	1,532	1,112	1,588	637	100	2,000	1,235	17,350
Iowa	173	178	173	152	86	137	143	173	139	122	196	158	1,830
Kansas	210	202	200	124	120	124	110	200	130	190	243	171	2,024
Kentucky:													
Eastern	4,305	3,931	2,732	4,864	5,162	3,540	2,714	3,940	1,712	421	4,627	3,664	41,612
Western	1,444	1,384	1,526	1,463	1,434	1,426	1,005	1,624	1,178	1,110	2,037	1,689	17,320
Maryland	85	75	52	72	52	58	37	40	25	6	60	48	610
Missouri	332	320	316	198	190	196	175	317	206	300	385	271	3,206
Montana (bituminous and lignite)	271	277	255	176	206	210	170	288	204	200	250	243	2,750
New Mexico	125	125	120	104	76	64	60	84	42	58	72	50	980
North and South Dakota (lignite)	287	308	236	148	157	137	140	188	306	405	356	352	3,020
Ohio	2,977	2,791	2,347	2,952	2,723	2,419	1,763	2,638	1,742	1,006	3,618	2,970	29,946
Oklahoma	295	300	254	137	111	118	89	185	159	250	364	248	2,510
Pennsylvania (bituminous)	11,253	10,697	7,284	10,827	10,908	7,418	5,228	7,531	3,704	1,310	8,137	7,186	91,483
Tennessee	438	406	294	477	480	365	240	398	148	14	383	380	4,023
Texas (bituminous and lignite)	5	5	4	3	3	2	3	3	3	3	3	3	40
Utah	675	652	725	526	491	361	268	534	244	418	665	325	5,884
Virginia	1,822	1,170	950	1,576	1,610	1,170	824	1,285	695	382	1,563	1,138	13,685
Washington	106	90	88	74	61	59	56	71	46	87	87	70	895
West Virginia:													
Southern [1]	9,165	8,627	5,957	9,975	10,490	7,297	5,780	7,247	3,537	163	8,018	6,738	82,994
Northern [2]	4,440	4,178	2,896	4,830	5,082	3,537	2,803	3,511	1,715	875	3,707	3,266	40,840
Wyoming	578	530	542	306	435	334	343	468	210	653	755	418	5,572
Other States [3]	4	4	3	1	2	1	(4)	1	2	4	5	4	31
Total 1949	48,800	46,315	33,762	47,425	47,795	35,476	27,071	37,615	19,783	10,307	44,623	36,028	435,000
Days and average production:													
Number of working days	25.1	24.0	27.0	25.0	25.4	26.0	25.0	27.0	25.0	26.0	25.3	26.0	306.8
Average production per working day	1,944	1,930	1,250	1,897	1,882	1,364	1,083	1,393	791	396	1,764	1,386	1,418

[1] Includes operations on the N. & W., C. & O., Virginian, T. & O. C., B. C. & G., and the B. & O. in Kanawha, Mason, and Clay Counties.
[2] Rest of State, including the Panhandle district and Grant, Mineral, and Tucker Counties.
[3] Comprises Arizona, Georgia, and Michigan.
[4] Less than 1,000 tons.

AVERAGE VALUE

TABLE 4.—Average value per ton, f. o. b. mines, bituminous coal and lignite produced in the United States, by States, 1948–49 [1]

State	1948			1949 (preliminary)
	Strip mines	Underground mines	Total all mines	
Alabama	$6.15	$6.15	$6.15	$6.13
Alaska	6.40	7.07	6.84	(2)
Arizona		5.26	5.26	(2)
Arkansas	5.82	8.67	7.75	(2)
California (lignite)	10.00		10.00	(2)
Colorado	4.41	4.97	4.94	5.15
Georgia		6.19	6.19	(2)
Illinois	3.83	3.90	3.88	4.05
Indiana	3.96	4.16	4.04	4.03
Iowa	3.70	4.65	4.20	(2)
Kansas	3.74	4.76	3.80	3.96
Kentucky	4.01	5.66	5.41	5.16
Maryland	4.33	5.60	5.26	(2)
Michigan		6.91	6.91	(2)
Missouri	3.80	4.98	3.90	4.03
Montana (bituminous and lignite)	1.28	4.04	2.22	2.21
New Mexico		5.09	5.09	5.10
North and South Dakota (lignite)	2.31	2.11	2.28	2.38
Ohio	3.58	4.48	4.01	3.82
Oklahoma	4.32	5.78	4.88	4.79
Pennsylvania	4.28	5.18	4.94	5.04
Tennessee	5.57	5.77	5.74	5.24
Texas (lignite)	1.02		1.02	(2)
Utah		4.56	4.56	4.70
Virginia	5.91	6.01	6.01	5.68
Washington	5.56	6.72	6.47	6.73
West Virginia	5.01	5.59	5.53	5.17
Wyoming	2.78	3.98	3.74	3.80
Total	4.11	5.26	4.99	4.85

[1] Average gross realization, selling cost not deducted.
[2] Included in total.

CONSUMPTION

TABLE 5.—Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States, 1933–49, in thousands of net tons

Year	Electric power utilities [1]	Bunker foreign trade [2]	Railroads [3] (class I)	Coke plants		Steel and rolling mills	Cement mills [4]	Other industrials [5]	Retail dealer deliveries [5]	Total of classes shown [6]
				Beehive	Oven					
1933	27,088	1,316	72,548	1,408	38,681	10,009	2,832	83,321	80,482	317,685
1934	29,707	1,321	76,037	1,635	44,343	10,898	3,500	89,448	86,925	343,814
1935	30,936	1,576	77,109	1,469	49,046	11,747	3,516	96,937	83,990	356,326
1936	38,104	1,622	86,391	2,698	63,244	13,471	4,771	113,792	84,200	408,293
1937	41,045	1,832	88,080	4,927	69,575	12,853	5,247	127,142	80,076	430,777
1938	36,440	1,352	73,921	1,360	45,266	8,412	4,483	96,527	68,520	336,281
1939	42,304	1,477	79,072	2,298	61,216	9,808	5,274	103,079	71,570	376,098
1940	49,126	1,426	85,130	4,803	76,583	10,040	5,633	110,469	87,700	430,910
1941	59,888	1,643	97,384	10,529	82,609	10,902	6,832	124,868	97,460	492,115
1942	63,472	1,585	115,410	12,876	87,974	10,434	7,570	135,979	104,750	540,050
1943	74,036	1,647	130,283	12,441	90,019	11,238	5,851	145,518	122,764	593,797
1944	76,656	1,559	132,049	10,858	94,438	10,734	3,789	134,610	124,906	589,599
1945	71,603	1,785	125,120	8,135	87,214	10,084	4,215	129,606	121,805	559,567
1946	68,743	1,381	110,166	7,167	76,121	8,603	7,009	120,610	100,586	500,386
1947	86,009	1,689	109,296	10,475	94,325	10,048	7,938	124,459	99,163	543,402
1948	95,620	1,057	94,838	10,322	96,984	10,046	8,554	112,741	89,747	519,909
1949 [7]	80,717	874	68,123	5,361	86,005	7,451	7,945	98,957	90,299	445,732

[1] Federal Power Commission. Represents latest available revised figures for bituminous coal and lignite consumed by public-utility power plants in power generation, including a small quantity of coke amounting to approximately 100,000 tons annually.

[2] Bureau of Census, U. S. Department of Commerce.

[3] Association of American Railroads. Represents consumption of bituminous coal and lignite by class I railways for all uses, including locomotive, powerhouse, shop, and station fuel. The Interstate Commerce Commission reports that in 1948 consumption for all uses by class I line-haul railways, plus purchases for class II and class III railways, plus purchases by all switching terminal companies combined was 99,793,401 tons of bituminous coal and lignite.

[4] Includes a small amount of anthracite.

[5] Estimates based upon receipts collected from a selected list of representative manufacturing plants and retail dealers.

[6] The total of classes shown approximates grand total consumption. It is not appropriate to "calculate" consumption from production, imports, exports and changes in stocks because certain significant items of stocks are not included in year-end stocks. These items are: Stocks on Lake and Tidewater docks, stocks at other intermediate storage piles between mine and consumer, and coal in transit.

[7] Preliminary figures.

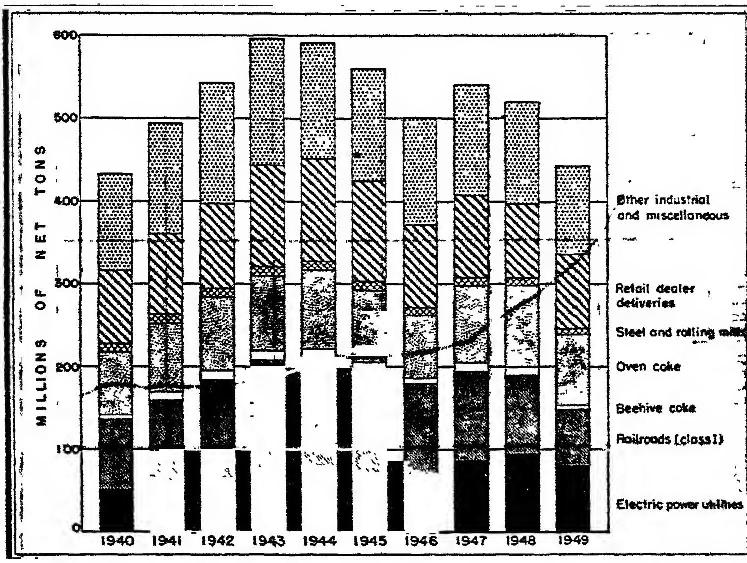

FIGURE 5.—Consumption of bituminous coal and lignite, by consumer class, with retail dealer deliveries in the United States, 1940–49.

FUEL EFFICIENCY

TABLE 6.—Fuel economy on consumption of coal at electric-utility power plants in the United States, 1919–49

Year	Pounds of coal per kilowatt-hour	Economy gain over 1919 (percent)	Year	Pounds of coal per kilowatt-hour	Economy gain over 1919 (percent)	Year	Pounds of coal per kilowatt-hour	Economy gain over 1919 (percent)
1919	3.20	----------	1930	1.60	50.0	1941	1.34	58.1
1920	3.00	6.2	1931	1.52	52.5	1942	1.30	59.4
1921	2.70	15.6	1932	1.49	53.4	1943	1.30	59.4
1922	2.50	21.9	1933	1.46	54.4	1944	1.29	59.7
1923	2.40	25.0	1934	1.45	54.7	1945	1.30	59.4
1924	2.20	31.3	1935	1.44	55.0	1946	1.29	59.7
1925	2.00	37.5	1936	1.44	55.0	1947	1.31	59.1
1926	1.90	40.6	1937	1.44	55.0	1948	1.30	59.4
1927	1.82	43.1	1938	1.40	56.3	1949	1.25	60.9
1928	1.73	45.9	1939	1.38	56.9			
1929	1.66	48.1	1940	1.34	58.1			

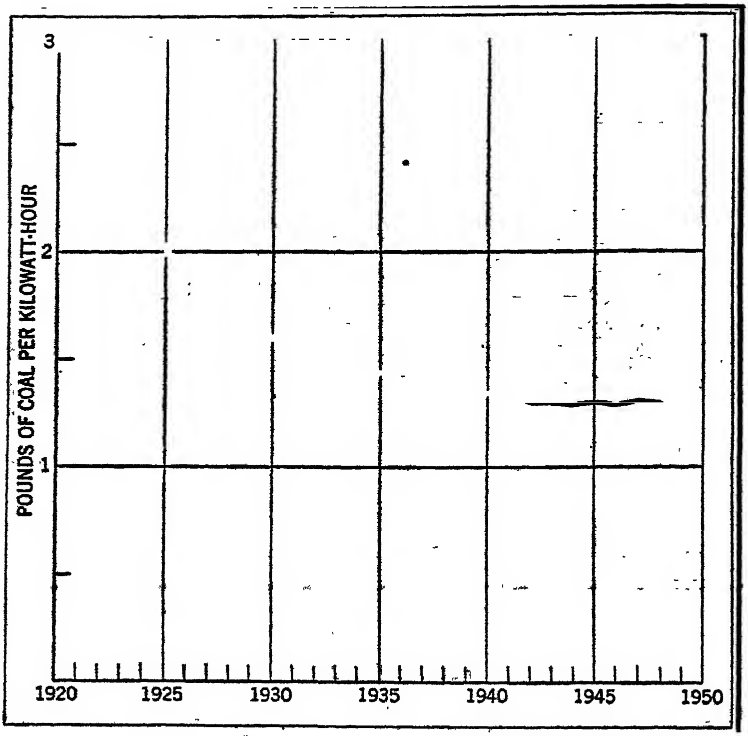

FIGURE 6.—Trend in fuel economy at electric-utility power plants in the United States, 1920–49.

RELATIVE RATE OF GROWTH OF COAL, OIL, AND WATER POWER, 1889–1949

The total supply of available energy in the form of coal, oil, natural gas, and water power in 1949 was 31,786 trillion B. t. u.—a 13.2 percent decrease from 1948.

The figures are expressed in British thermal units because some common denominator is necessary for such unlike quantities as tons of coal, barrels of oil, and cubic feet of gas. Table 7 summarizes the equivalent of each of the fuels in trillions of British thermal units. Water power is represented by the equivalent fuel required to perform the same work. The table covers the years 1889 and 1899 to 1949.

In converting water power to its equivalent of fuel required to perform the same work, the *prevailing* or average performance of all fuel-burning central electric stations for each year in question has been used. This average has declined from about 7.05 pounds of coal per kilowatt-hour in 1899 to 1.25 in 1949, which shows the influence of improving fuel efficiency. The *prevailing* fuel equivalent closely approximates the quantity of fuel that would have been needed in any one year to generate the same power in a steam-electric station. It should be noted, however, that the ultimate use of the water power generated often displaces fuel burned much less efficiently than in central stations and that no other important branch of fuel consump-

tion has made advances in fuel efficiency approaching that of the central stations. As these tables attempt to determine the total energy from all fuels and from water power, the ideal factor for converting water power into fuel equivalent would be the average efficiency of all forms of fuel consumption in each year. No basis for determining such an all-embracing average exists at present, but enough is known to make certain that it would show much less reduction from 1899 to 1949 than do the central stations.

The figures for oil represent production of crude petroleum and imports; the figures for natural gas represent marketed production. Most of this production does not come into direct competition with coal. Much of the supply of both oil and gas is used in regions of the country, such as California and portions of the Southwest, where coal

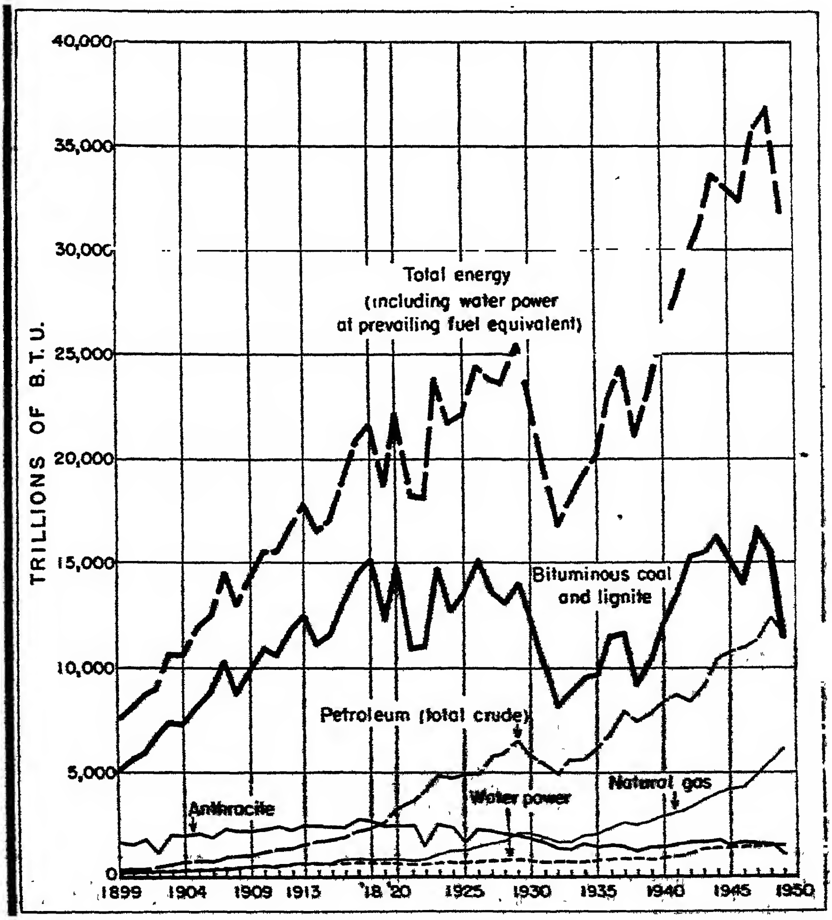

FIGURE 7.—Annual supply of energy from mineral fuels and water power in the United States, 1899–1949.

is available only at unusually high cost because of heavy transportation charges. Nearly half of the natural gas is used in the field for drilling or operating oil and gas wells and pipelines or for the manufacture of carbon black. More than half of the oil is used in the form of gasoline, kerosine, and lubricants, for which purposes coal cannot well compete, except at very much higher levels of oil prices. Even these refined products, however, involve a certain measure of indirect competition with coal, for the energy market of the country is becoming more fluid and competitive, and a demand that cannot be met by one source of supply tends to fall back on the others.

The subject of interfuel competition is exceedingly complex, and an elaborate analysis and the accumulation of data not now available would be required to determine even approximately how much of any one fuel actually has been displaced either by other fuels or by water power. The present tables do not permit determination of such displacement; their purpose is rather to measure the long-time trends in the total demand for energy.

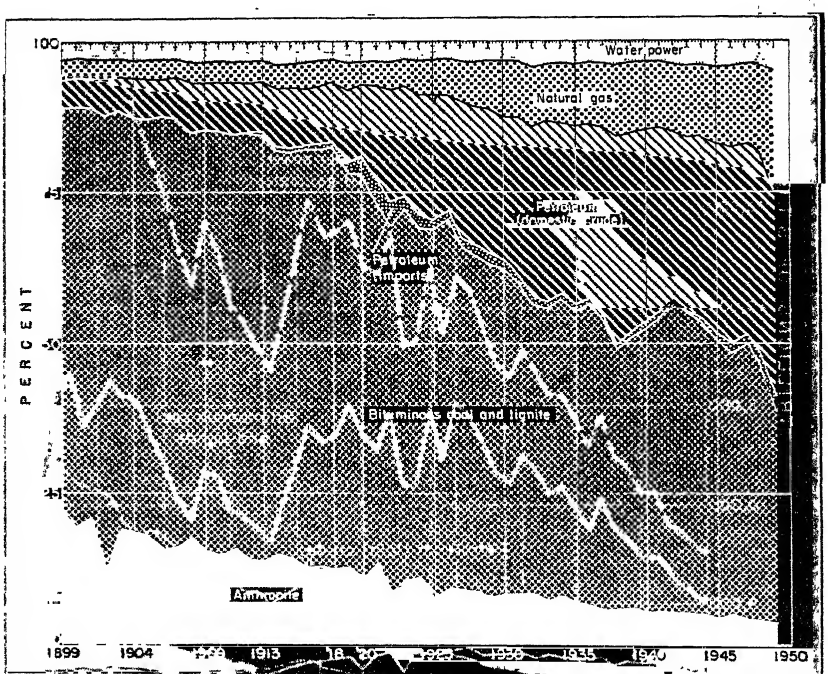

FIGURE 8.—Percentage of total British thermal units equivalent contributed by the several sources of energy in the United States, counting water power at the prevailing fuel equivalent of central stations in each year, 1899–1949.

TABLE 7.—Annual supply of energy from mineral fuels and water power in the United States, 1889 and 1899–1949, in trillions of British thermal units[1]

[Anthracite and petroleum unit heat averages revised]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (crude): Domestic production	Petroleum (crude): Imports	Natural gas (marketed production)	Total petroleum and natural gas	Total mineral fuels	Water power[2]	Grand total
1889	1,157	2,507	3,664	204	-------	268	472	4,136	(3)	(3)
1899	1,535	5,065	6,600	331	-------	240	571	7,171	238	7,409
1900	1,457	5,563	7,020	369	-------	254	623	7,643	250	7,893
1901	1,714	5,917	7,631	402	-------	283	685	8,316	264	8,580
1902	1,051	6,818	7,869	515	-------	301	816	8,685	289	8,974
1903	1,895	7,408	9,303	583	-------	319	902	10,205	321	10,526
1904	1,858	7,301	9,159	679	-------	333	1,012	10,171	354	10,525
1905	1,973	8,255	10,228	781	-------	377	1,158	11,386	386	11,772
1906	1,811	8,983	10,794	734	-------	418	1,152	11,946	414	12,360
1907	2,174	10,343	12,517	963	-------	437	1,400	13,917	441	14,358
1908	2,115	8,713	10,828	1,035	-------	432	1,467	12,295	476	12,771
1909	2,059	9,949	12,008	1,062	-------	517	1,579	13,587	513	14,100
1910	2,146	10,928	13,074	1,215	3	547	1,765	14,839	539	15,378
1911	2,298	10,635	12,933	1,279	8	551	1,838	14,771	565	15,336
1912	2,143	11,793	13,936	1,293	40	604	1,937	15,873	585	16,458
1913	2,325	12,535	14,860	1,441	98	626	2,165	17,025	609	17,634
1914	2,307	11,075	13,382	1,541	98	636	2,275	15,657	636	16,293
1915	2,260	11,597	13,857	1,630	105	676	2,411	16,268	659	16,927
1916	2,224	13,166	15,390	1,744	121	810	2,675	18,065	681	18,746
1917	2,530	14,457	16,987	1,945	175	855	2,975	19,962	700	20,662
1918	2,510	15,180	17,690	2,064	219	775	3,058	20,748	701	21,449
1919	2,238	12,206	14,444	2,195	306	802	3,303	17,747	718	18,465
1920	2,276	14,899	17,175	2,569	616	858	4,043	21,218	738	21,956
1921	2,298	10,897	13,195	2,739	727	712	4,178	17,373	620	17,993
1922	1,389	11,063	12,452	3,234	738	820	4,792	17,244	643	17,887
1923	2,371	14,792	17,163	4,248	476	1,083	5,807	22,970	685	23,655
1924	2,233	12,672	14,905	4,141	451	1,228	5,820	20,725	648	21,373
1925	1,570	13,625	15,195	4,430	359	1,278	6,067	21,262	668	21,930
1926	2,145	15,022	17,167	4,471	350	1,411	6,232	23,399	728	24,127
1927	2,034	13,565	15,599	5,227	339	1,553	7,119	22,718	776	23,494
1928	1,914	13,120	15,034	5,229	463	1,686	7,378	22,412	854	23,266
1929	1,875	14,017	15,892	5,842	458	2,062	8,362	24,254	816	25,070
1930	1,762	12,249	14,011	5,208	360	2,089	7,657	21,668	752	22,420
1931	1,515	10,011	11,526	4,936	274	1,813	7,023	18,549	668	19,217
1932	1,266	8,114	9,380	4,554	259	1,673	6,486	15,866	713	16,579
1933	1,258	8,741	9,999	5,253	185	1,672	7,110	17,109	711	17,820
1934	1,452	9,415	10,867	5,267	206	1,904	7,377	18,244	698	18,942
1935	1,325	9,756	11,081	5,780	187	2,060	8,027	19,108	806	19,914
1936	1,386	11,504	12,890	6,378	187	2,330	8,895	21,785	812	22,597
1937	1,317	11,673	12,990	7,419	159	2,588	10,166	23,156	871	24,027
1938	1,171	9,132	10,303	7,043	153	2,468	9,664	19,967	866	20,833
1939	1,308	10,345	11,653	7,337	192	2,663	10,192	21,845	838	22,683
1940	1,308	12,072	13,380	7,849	247	2,860	10,956	24,336	880	25,216
1941	1,432	13,471	14,903	8,133	294	3,024	11,451	26,354	934	27,288
1942	1,532	15,267	16,799	8,043	71	3,282	11,396	28,195	1,136	29,331
1943	1,540	15,463	17,003	8,733	80	3,671	12,484	29,487	1,304	30,791
1944	1,618	16,233	17,851	9,732	260	3,989	13,981	31,832	1,344	33,176
1945	1,395	15,134	16,529	9,939	429	4,213	14,581	31,110	1,442	32,552
1946	1,537	13,989	15,526	10,057	517	4,333	14,907	30,433	1,406	31,839
1947	1,453	16,522	17,975	10,771	576	4,926	16,273	34,248	1,426	35,674
1948[4]	1,451	15,707	17,158	11,717	745	5,534	17,996	35,154	1,481	36,635
1949[4]	1,084	11,397	12,481	10,674	898	6,181	17,753	30,234	1,552	31,786

[1] The unit heat values employed are: Anthracite, 12,700 B. t. u. per pound; bituminous coal and lignite, 13,100 B. t. u. per pound; petroleum 5,800,000 B. t. u. per barrel; natural gas, 1,075 B. t. u. per cubic foot. ~~Water power includes installations owned by manufacturing plants and mines as well as Government and~~ privately owned public utilities. The fuel equivalent of water power is calculated from the kilowatt-hours of power produced wherever available, as it is of all public-utility plants since 1919. Otherwise, the fuel equivalent is calculated from the reported horsepower of installed water wheels, assuming a capacity factor of 20 percent for manufacturers and mines and of 40 percent for public utilities.

[2] Fuel equivalent calculated by assuming the average central-station practice for each of the years for which data are available.

[3] Data not available.

[4] Preliminary figures.

TABLE 8.—Index numbers for relative rate of growth of coal, oil, and water power in the United States, 1889 and 1899–1949

[1918=100]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (crude)		Natural gas (marketed production)	Total petroleum and natural gas	Total mineral fuels	Water power	Grand total
				Domestic production	Imports					
1889	46	17	21	10		35	15	20	(1)	(1)
1899	61	33	37	16		31	19	35	34	35
1900	58	37	40	18		33	20	37	36	37
1901	68	39	43	19		37	22	40	38	40
1902	42	45	44	25		39	27	42	41	42
1903	75	49	53	28		41	29	49	46	49
1904	74	48	52	33		43	33	49	50	49
1905	79	54	58	38		49	38	55	55	55
1906	72	59	61	36		54	38	58	59	58
1907	87	68	71	47		56	46	67	63	67
1908	84	57	61	50		56	48	59	68	60
1909	82	66	68	51		67	52	65	73	66
1910	85	72	74	59	1	71	58	72	77	72
1911	92	70	73	62	4	71	60	71	81	71
1912	85	78	79	63	18	78	63	77	83	77
1913	93	83	84	70	45	81	71	82	87	82
1914	92	73	76	75	45	82	74	75	91	76
1915	90	76	78	79	48	87	79	78	94	79
1916	89	87	87	84	55	105	87	87	97	87
1917	101	95	96	94	80	110	97	96	100	96
1918	100	100	100	100	100	100	100	100	100	100
1919	89	80	82	106	140	103	108	86	102	86
1920	91	98	97	124	281	111	132	102	105	102
1921	92	72	75	133	332	92	137	84	88	84
1922	55	73	70	157	337	106	157	83	92	83
1923	94	97	97	206	217	140	190	111	98	110
1924	89	83	84	201	206	158	190	100	92	100
1925	63	90	86	215	164	165	198	102	95	102
1926	85	99	97	217	160	182	204	113	104	112
1927	81	89	88	253	155	201	233	109	111	110
1928	75	86	85	253	211	218	241	108	122	108
1929	75	92	90	283	209	266	273	117	116	117
1930	70	81	79	252	164	270	250	104	107	105
1931	60	66	65	239	125	234	230	89	95	90
1932	50	53	53	221	118	216	212	77	102	77
1933	50	57	57	255	84	216	233	82	101	83
1934	58	62	61	255	94	246	241	88	100	88
1935	53	64	63	280	85	266	262	92	115	93
1936	55	76	73	309	85	301	291	105	116	105
1937	52	77	73	359	73	334	332	112	124	112
1938	47	60	58	341	70	318	316	96	124	97
1939	52	68	66	355	88	344	333	105	120	106
1940	52	89	76	380	113	369	358	117	126	118
1941	57	89	84	394	134	390	374	127	133	127
1942	61	101	95	390	32	423	373	136	162	137
1943	61	103	96	423	37	474	408	142	186	144
1944	64	107	101	472	119	515	457	153	192	155
1945	56	100	93	482	196	544	477	150	206	152
1946	61	92	88	487	236	559	487	147	201	148
1947	58	109	102	522	263	636	532	165	203	166
1948 [2]	58	103	97	568	340	714	588	169	201	171
1949 [2]	43	75	71	517	410	798	581	146	221	148

[1] Data not available.
[2] Preliminary figures.

TABLE 9.—Percentage of total British thermal unit equivalent contributed by the several mineral fuels and water power in the United States, 1899–1949 [1]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (crude)		Natural gas (marketed production)	Total petroleum and natural gas	Total mineral fuels	Water power	Grand total
				Domestic production	Imports					
1899	20.7	68.4	89.1	4.5	------	3.2	7.7	96.8	3.2	100.0
1900	18.4	70.5	88.9	4.7	------	3.2	7.9	96.8	3.2	100.0
1901	20.0	68.9	88.9	4.7	------	3.3	8.0	96.9	3.1	100.0
1902	11.7	76.0	87.7	5.7	------	3.4	9.1	96.8	3.2	100.0
1903	18.0	70.4	88.4	5.6	------	3.0	8.6	97.0	3.0	100.0
1904	17.6	69.4	87.0	6.4	------	3.2	9.6	96.6	3.4	100.0
1905	16.8	70.1	86.9	6.6	------	3.2	9.8	96.7	3.3	100.0
1906	14.7	72.7	87.4	5.9	------	3.4	9.3	96.7	3.3	100.0
1907	15.2	72.0	87.2	6.7	------	3.0	9.7	96.9	3.1	100.0
1908	16.6	68.2	84.8	8.1	------	3.4	11.5	96.3	3.7	100.0
1909	14.6	70.6	85.2	7.5	------	3.7	11.2	96.4	3.6	100.0
1910	13.9	71.1	85.0	7.9	------	3.6	11.5	96.5	3.5	100.0
1911	15.0	69.3	84.3	8.3	0.1	3.6	12.0	96.3	3.7	100.0
1912	13.0	71.7	84.7	7.8	.2	3.7	11.7	96.4	3.6	100.0
1913	13.2	71.0	84.2	8.2	.6	3.5	12.3	96.5	3.5	100.0
1914	14.1	68.0	82.1	9.5	.6	3.9	14.0	96.1	3.9	100.0
1915	13.4	68.5	81.9	9.6	.6	4.0	14.2	96.1	3.9	100.0
1916	11.9	70.2	82.1	9.3	.7	4.3	14.3	96.4	3.6	100.0
1917	12.2	70.0	82.2	9.4	.9	4.1	14.4	96.6	3.4	100.0
1918	11.7	70.8	82.5	9.6	1.0	3.6	14.2	96.7	3.3	100.0
1919	12.1	66.1	78.2	11.9	1.7	4.3	17.9	96.1	3.9	100.0
1920	10.4	67.8	78.2	11.7	2.8	3.9	18.4	96.6	3.4	100.0
1921	12.8	60.6	73.4	15.2	4.0	4.0	23.2	96.6	3.4	100.0
1922	7.8	61.8	69.6	18.1	4.1	4.6	26.8	96.4	3.6	100.0
1923	10.0	62.6	72.6	17.9	2.0	4.6	24.5	97.1	2.9	100.0
1924	10.5	59.3	69.8	19.4	2.1	5.7	27.2	97.0	3.0	100.0
1925	7.2	62.1	69.3	20.2	1.7	5.8	27.7	97.0	3.0	100.0
1926	8.9	62.3	71.2	18.5	1.5	5.8	25.8	97.0	3.0	100.0
1927	8.7	57.7	66.4	22.3	1.4	6.6	30.3	96.7	3.3	100.0
1928	8.2	56.4	64.6	22.5	2.0	7.2	31.7	96.3	3.7	100.0
1929	7.5	55.9	63.4	23.3	1.8	8.2	33.3	96.7	3.3	100.0
1930	7.9	54.6	62.5	23.2	1.6	9.3	34.1	96.6	3.4	100.0
1931	7.9	52.1	60.0	25.7	1.4	9.4	36.5	96.5	3.5	100.0
1932	7.6	49.0	56.6	27.5	1.5	10.1	39.1	95.7	4.3	100.0
1933	7.1	49.0	56.1	29.5	1.0	9.4	39.9	96.0	4.0	100.0
1934	7.7	49.7	57.4	27.8	1.1	10.0	38.9	96.3	3.7	100.0
1935	6.7	49.0	55.7	29.0	.9	10.4	40.3	96.0	4.0	100.0
1936	6.1	50.9	57.0	28.2	.9	10.3	39.4	96.4	3.6	100.0
1937	5.5	48.6	54.1	30.9	.6	10.8	42.3	96.4	3.6	100.0
1938	5.6	43.8	49.4	33.8	.7	11.9	46.4	95.8	4.2	100.0
1939	5.8	45.6	51.4	32.3	.9	11.7	44.9	96.3	3.7	100.0
1940	5.2	47.9	53.1	31.1	1.0	11.3	43.4	96.5	3.5	100.0
1941	5.2	49.4	54.6	29.8	1.1	11.1	42.0	96.6	3.4	100.0
1942	5.2	52.1	57.3	27.4	.2	11.2	38.8	96.1	3.9	100.0
1943	5.0	50.2	55.2	28.4	.3	11.9	40.6	95.8	4.2	100.0
1944	4.9	48.9	53.8	29.3	.8	12.0	42.1	95.9	4.1	100.0
1945	4.3	46.5	50.8	30.5	1.3	13.0	44.8	95.6	4.4	100.0
1946	4.8	44.0	48.8	31.6	1.6	13.6	46.8	95.6	4.4	100.0
1947	4.1	46.3	50.4	30.2	1.6	13.8	45.6	96.0	4.0	100.0
1948 [2]	4.0	42.9	46.9	32.0	2.0	15.1	49.1	96.0	4.0	100.0
1949 [2]	3.4	35.9	39.3	33.6	2.8	19.4	55.8	95.1	4.9	100.0

[1] Percentages based upon figures in table 7.
[2] Preliminary figures.

STOCKS HELD BY CONSUMERS

TABLE 10.—Stocks of bituminous coal and lignite in hands of commercial consumers and in retail dealers' yards in the United States, 1948–49

Date	Total stocks (net tons)	Days' supply at current rate of consumption on date of stock taking							
		Coke ovens	Steel plants	Other industrials	Electric utilities	Retail yards	Railroads	Cement mills	Total
1948									
Jan. 1	52,161,000	34	32	52	62	6	22	46	33
Feb. 1	49,576,000	32	26	38	56	3	22	46	28
Mar. 1	48,613,000	32	28	51	55	3	22	45	30
Apr. 1	43,585,000	28	27	52	54	3	21	44	30
May 1	34,418,000	20	28	46	51	6	21	36	30
June 1	47,082,000	29	41	54	64	7	29	45	37
July 1	58,010,000	39	48	67	68	9	35	59	45
Aug. 1	58,139,000	34	53	67	75	13	35	59	47
Sept. 1	64,057,000	38	51	58	80	15	36	57	47
Oct. 1	67,592,000	40	50	58	83	14	36	60	48
Nov. 1	68,696,000	41	43	53	85	12	36	56	46
Dec. 1	69,579,000	42	39	50	90	15	36	54	47
Dec. 31	69,373,000	43	38	53	90	9	38	52	46
1949									
Jan. 1	69,373,000	43	38	53	90	9	38	52	46
Feb. 1	67,795,000	45	36	49	91	7	39	50	44
Mar. 1	68,834,000	49	39	49	94	6	42	48	46
Apr. 1	60,511,000	42	37	45	93	5	42	46	42
May 1	65,164,000	47	49	55	111	10	46	51	52
June 1	72,755,000	59	68	70	128	15	51	66	65
July 1	74,161,000	63	74	84	121	15	56	76	68
Aug. 1	69,119,000	61	75	77	126	21	54	72	72
Sept. 1	68,621,000	57	65	66	117	16	49	70	63
Oct. 1	62,064,000	50	59	56	114	7	43	68	51
Nov. 1	47,165,000	42	52	42	97	7	28	48	44
Dec. 1	45,804,000	42	52	34	87	5	24	44	37
Dec. 31	45,111,000	39	39	35	77	4	21	45	32

FINAL BITUMINOUS-COAL AND LIGNITE STATISTICS FOR 1948

Tables 11 to 52 give final detailed statistics of bituminous-coal and lignite mine operations in 1948. The subjects covered include production, number and size of mines, employment, value, mechanization, exports, and world production.

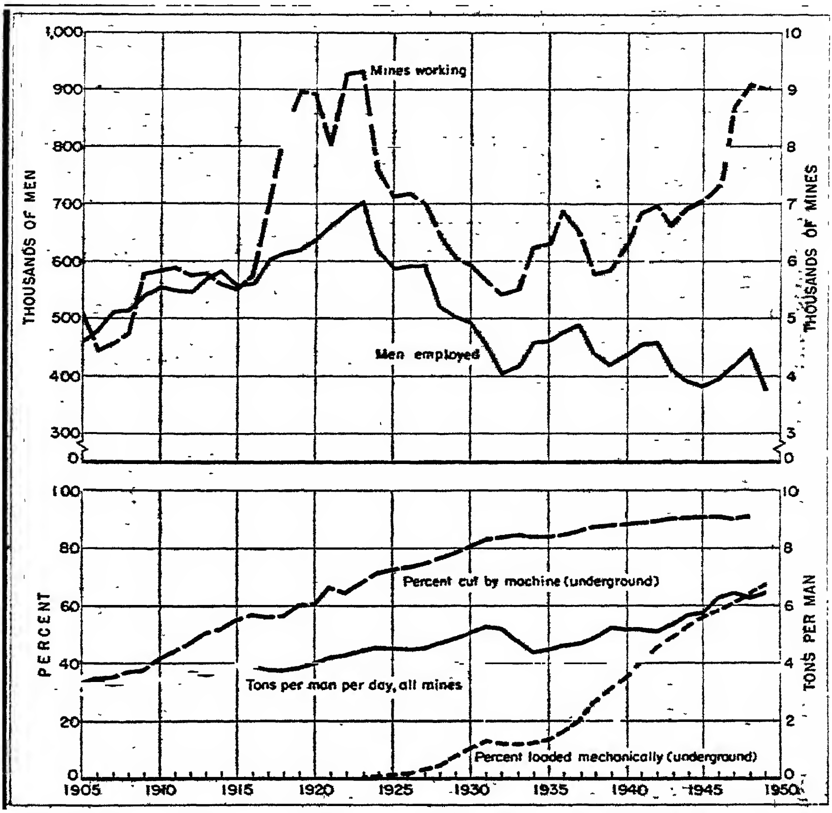

FIGURE 9.—Trends of employment, mechanization, and output per man at bituminous-coal and lignite mines in the United States, 1905–49.

SALIENT TRENDS

TABLE 11.—Salient trends in bituminous-coal and lignite mining industry in the United States, 1941–48

	1941	1942	1943	1944	1945	1946	1947	1948
Production:								
Loaded at mine for shipment by rail [1] net tons	425,184,319	482,814,042	495,863,581	527,135,489	490,471,988	450,615,524	527,281,632	498,193,877
Loaded at mine for shipment by water [2] do	30,240,489	34,018,025	30,188,093	31,518,334	27,547,679	24,641,533	29,802,779	26,734,786
Shipped by truck or wagon do	40,058,638	45,154,432	42,432,667	40,123,023	41,477,428	42,730,884	55,859,262	58,260,437
Taken by locomotive tenders at tipple do	1,099,582	920,213	779,154	807,679	694,555	731,748		
Shipped by conveyor or tram to point of consumption do	6,067,697	7,121,116	7,476,717	7,206,392	6,416,327	5,700,870		
Used by mine employees do	1,872,026	2,180,077	2,549,775	2,545,343	2,660,039	2,464,300	17,080,049	16,329,129
Used at mines for power and heat do	2,483,950	2,708,312	2,701,828	2,713,073	2,442,398	1,950,645		
Made into beehive coke at mines do	7,140,544	7,776,720	8,185,254	7,526,907	5,906,913	5,086,564		
Total production do	514,149,246	582,692,937	590,177,069	619,576,240	577,617,327	533,922,068	630,623,722	599,518,229
Number of active mines of commercial size:								
Class 1 (200,000 tons or more) number	730	811	855	828	753	706	801	755
Class 2 (100,000 to 200,000 tons) do	437	484	464	559	591	560	618	580
Class 3 (50,000 to 100,000 tons) do	402	445	481	540	629	637	704	768
Class 4 (10,000 to 50,000 tons) do	1,305	1,492	1,544	1,776	1,920	2,016	2,665	2,697
Class 5 (1,000 to 10,000 tons) do	3,948	3,740	3,276	3,225	3,140	3,414	3,912	4,279
Total number 1,000 tons and over do	6,823	6,972	6,620	6,928	7,033	7,333	8,700	9,079
Average number of men employed at mines active:								
Underground men	376,765	374,654	326,763	301,461	290,001	[3] 296,030	[3] 311,369	[3] 330,292
Surface:								
In strip pits do	10,861	12,893	16,643	21,035	23,261	[3] 25,408	[3] 29,783	[3] 32,178
All others do	69,355	74,444	72,601	70,851	69,838	[3] 74,996	[3] 78,030	[3] 79,161
Total do	456,981	461,991	416,007	393,347	383,100	[3] 396,434	[3] 419,182	[3] 441,631
Average number of days mines operated	216	246	264	278	261	214	234	217
Capacity of active mines with existing labor force, per year of 280 days net tons	666,000,000	663,000,000	626,000,000	624,000,000	620,000,000	699,000,000	755,000,000	774,000,000
Output per man per day do	5.20	5.12	5.38	5.67	5.78	6.30	6.42	6.26
Output per man per year do	1,125	1,261	1,419	1,575	1,508	1,347	1,504	1,358
Undergound output cut by machine do	408,510,296	462,344,719	461,051,743	469,458,349	424,726,432	382,133,540	442,191,535	460,012,309
Percent of underground output cut by machine	89.0	89.7	90.3	90.5	90.8	90.8	90.0	90.7
Underground output mechanically loaded net tons	186,667,250	232,902,920	249,805,214	274,189,132	262,512,729	245,340,768	298,157,281	295,806,285
Percent of underground output mechanically loaded	40.7	45.2	48.9	52.9	56.1	58.4	60.7	64.3
Quantity mined by stripping net tons	55,071,609	67,202,663	79,685,175	100,898,376	109,986,865	112,963,717	139,395,011	139,505,920
Percent mined by stripping	10.7	11.5	13.5	16.3	19.0	21.1	22.1	23.3
Quantity cleaned by wet or pneumatic process [4] net tons	117,539,522	142,187,346	145,575,849	158,727,129	147,885,936	138,669,837	174,435,937	180,880,323
Percent cleaned by wet or pneumatic process [4]	22.9	24.4	24.7	25.6	25.6	26.0	27.7	30.2

[1] Includes coal trucked to railroad for further shipment.
[2] Includes coal trucked to waterway for further shipment.
[3] Average number of men working daily.
[4] Includes central washeries operated by consumers.

TABLE 12.—Coal produced in the United States, by States, 1939–48 with production of maximum year and cumulative production from earliest record to end of 1948, in thousands of net tons

State	Maximum production		Production by years										Total production from earliest record to end of 1948
	Year	Quantity	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	
Alabama	1926	21,001	12,047	15,324	15,464	19,301	17,160	18,752	18,236	16,188	19,048	18,501	809,344
Arkansas	1907	2,670	1,152	1,454	1,574	1,985	1,718	1,972	1,854	1,631	1,871	1,662	90,414
Colorado	1917	12,483	5,923	6,589	6,949	8,086	8,324	8,168	7,621	5,914	6,358	5,631	466,485
Georgia	1903	416	(1)	(1)	(1)	31	14	24	43	114	7	20	(1)
Illinois	1918	89,291	46,783	50,610	54,703	65,071	72,631	76,792	73,011	63,409	67,860	65,342	3,084,075
Indiana	1918	30,679	16,943	18,869	22,484	25,388	25,065	27,962	25,183	21,697	25,449	23,849	968,738
Iowa	1917	8,966	2,948	3,231	2,939	2,948	2,771	2,141	2,046	1,788	1,684	1,670	336,008
Kansas	1918	7,562	2,675	3,579	4,008	4,230	3,437	3,369	3,228	2,493	2,745	2,538	204,020
Kentucky	1947	84,241	42,557	49,141	53,710	62,231	63,211	71,356	69,593	66,553	84,241	82,084	1,893,191
Maryland	1907	5,533	1,443	1,503	1,701	2,001	1,933	1,870	1,763	2,003	2,051	1,661	259,157
Michigan	1907	2,036	457	410	311	231	169	140	126	80	14	13	46,361
Missouri	1917	5,671	3,273	3,097	3,145	3,520	4,310	4,770	3,983	3,733	4,236	4,023	253,821
Montana (bituminous and lignite)	1944	4,844	2,804	2,867	3,254	3,829	4,833	4,844	4,467	3,723	3,178	2,898	154,497
New Mexico	1918	4,023	1,230	1,111	1,251	1,669	1,851	1,744	1,484	1,280	1,443	1,364	120,436
North Carolina	1922	79	----	----	----	----	----	----	----	----	----	----	(1)
North Dakota (lignite)	1948	2,961	2,072	2,218	2,309	2,537	2,500	2,366	2,522	2,555	2,760	2,961	64,673
Ohio	1920	45,878	20,289	22,772	29,319	32,764	32,255	33,877	32,737	32,314	37,548	38,708	1,066,721
Oklahoma	1920	4,849	1,188	1,646	1,771	2,387	2,838	3,209	2,909	2,647	3,421	3,462	155,753
Pennsylvania (bituminous)	1918	178,551	92,584	116,603	130,240	144,073	141,050	146,052	132,965	125,497	147,079	134,542	7,276,576
Tennessee	1942	8,158	5,185	6,008	7,045	8,158	7,179	7,266	6,271	5,618	6,258	6,483	320,140
Texas (bituminous and lignite)	1913	2,429	826	621	353	304	153	[2] 109	[2] 80	[2] 56	[2] 61	[2] 57	60,862
Utah	1947	7,429	3,285	3,576	4,077	5,517	6,666	7,119	6,679	5,994	7,429	6,813	191,706
Virginia	1943	20,280	13,531	15,348	18,441	20,136	20,280	19,514	17,235	15,527	20,171	17,999	539,539
Washington	1918	4,082	1,690	1,650	1,841	1,953	1,528	1,524	1,357	901	1,118	1,220	141,550
West Virginia	1947	176,157	108,362	126,438	140,250	155,882	158,804	164,704	152,035	144,020	176,157	168,862	4,839,133
Wyoming	1945	9,847	5,373	5,808	6,646	8,133	9,155	9,540	9,847	7,635	8,051	6,412	357,460
Other States	----	----	235	299	364	328	342	383	342	407	386	443	65,477
Total bituminous and lignite	1947	630,624	394,855	460,772	514,149	582,693	590,177	619,576	577,617	533,922	630,624	599,518	24,426,137
Pennsylvania anthracite	1917	99,612	51,487	51,485	56,368	60,328	60,644	63,701	54,934	60,507	57,190	57,140	4,856,241
Grand total	----	----	446,342	512,257	570,517	643,021	650,821	683,277	632,551	594,429	687,814	656,658	29,282,378

[1] Included with "Other States."
[2] Lignite only.

TABLE 13.—Growth of the bituminous-coal and lignite-mining industry in the United States, 1890–1948

Year	Production (net tons)	Value of production [1]		Men employed	Number of mines	Capacity at 280 days (million tons)
		Total	Average per ton			
1890	111,302,322	$110,420,801	$0.99	192,204	(2)	137
1891	117,901,238	117,188,400	.99	205,803	(2)	148
1892	126,856,567	125,124,381	.99	212,893	(2)	162
1893	128,385,231	122,751,618	.96	230,365	(2)	174
1894	118,820,405	107,653,501	.91	244,603	(2)	196
1895	135,118,193	115,779,771	.86	239,962	2,555	196
1896	137,640,276	114,891,515	.83	244,171	2,599	202
1897	147,617,519	119,595,224	.81	247,817	2,454	213
1898	166,593,623	132,608,713	.80	255,717	2,862	221
1899	193,323,187	167,952,104	.87	271,027	3,245	230
1900	212,316,112	220,930,313	1.04	304,375	(2)	255
1901	225,828,149	236,422,049	1.05	340,235	(2)	281
1902	260,216,844	290,858,483	1.12	370,056	(2)	316
1903	282,749,348	351,687,933	1.24	415,777	(2)	350
1904	278,659,689	305,397,001	1.10	437,832	4,650	386
1905	315,062,785	334,658,294	1.06	460,629	5,060	417
1906	342,874,867	381,162,115	1.11	478,425	4,430	451
1907	394,759,112	451,214,842	1.14	513,258	4,550	473
1908	332,573,944	374,135,268	1.12	516,264	4,730	482
1909	379,744,257	405,486,777	1.07	543,152	5,775	510
1910	417,111,142	469,281,719	1.12	555,533	5,818	538
1911	405,907,059	451,375,819	1.11	549,775	5,887	538
1912	450,104,982	517,983,445	1.15	548,632	5,747	566
1913	478,435,297	565,234,952	1.18	571,882	5,776	577
1914	422,703,970	493,309,244	1.17	583,506	5,592	608
1915	442,624,426	502,037,688	1.13	557,456	5,502	610
1916	502,519,682	665,116,077	1.32	561,102	5,726	613
1917	551,790,563	1,249,272,837	2.26	603,143	6,939	636
1918	579,385,820	1,491,809,940	2.58	615,305	8,319	650
1919	465,860,058	1,160,616,013	2.49	621,998	8,994	669
1920	568,666,683	2,129,933,000	3.75	639,547	8,921	725
1921	415,921,950	1,199,983,600	2.89	663,754	8,038	781
1922	422,268,099	1,274,820,000	3.02	687,958	9,299	832
1923	564,564,662	1,514,621,000	2.68	704,793	9,331	885
1924	483,686,538	1,062,626,000	2.20	619,604	7,586	792
1925	520,052,741	1,060,402,000	2.04	588,493	7,144	748
1926	573,366,985	1,183,412,000	2.06	593,647	7,177	747
1927	517,763,352	1,029,657,000	1.99	593,918	7,011	759
1928	500,744,970	933,774,000	1.86	522,150	6,450	691
1929	534,988,593	952,781,000	1.78	502,993	6,057	679
1930	467,526,299	795,483,000	1.70	493,202	5,891	700
1931	382,089,396	588,895,000	1.54	450,213	5,642	669
1932	309,709,872	406,677,000	1.31	406,380	5,427	594
1933	333,630,533	445,788,000	1.34	418,703	5,555	559
1934	359,368,022	628,383,000	1.75	458,011	6,258	565
1935	372,373,122	658,063,000	1.77	462,403	6,315	582
1936	439,087,903	770,955,000	1.76	477,204	6,875	618
1937	445,531,449	864,042,000	1.94	491,864	6,548	646
1938	348,544,764	678,653,000	1.95	441,333	5,777	602
1939	394,855,325	728,348,366	1.84	421,788	5,820	621
1940	460,771,500	879,327,227	1.91	439,075	6,324	639
1941	514,149,245	1,125,362,836	2.19	456,981	6,822	666
1942	582,692,937	1,373,990,608	2.36	461,991	6,972	663
1943	590,177,069	1,584,644,477	2.69	416,007	6,620	626
1944	619,576,240	1,810,900,542	2.92	393,347	6,928	624
1945	577,617,327	1,768,204,320	3.06	383,100	7,033	620
1946	533,922,068	1,835,539,476	3.44	[3] 396,434	7,333	699
1947	630,623,722	2,622,634,946	4.16	[3] 419,182	8,700	755
1948	599,518,229	2,993,153,747	4.99	[3] 441,631	9,079	774

[1] Figures for 1890 to 1936 and 1939 exclude selling expense. Figures for 1937–38 and 1940–48 include selling expense.
[2] Data not available.
[3] Average number of men working daily.

TABLE 13.—Growth of the bituminous-coal and lignite-mining industry in the United States, 1890–1948—Continued

Year	Average number of days worked	Average days lost per man on strike	Net tons per man—		Percent of underground production—		Percent of total production—	
			Per day	Per year	Cut by machines [4]	Mechanically loaded	Mechanically cleaned [5]	Mined by stripping
1890	226	(2)	2.56	579	(2)	(2)	(2)	(2)
1891	223	(2)	2.57	573	5.3	(2)	(2)	(2)
1892	219	(2)	2.72	596	(2)	(2)	(2)	(2)
1893	204	(2)	2.73	557	(2)	(2)	(2)	(2)
1894	171	(2)	2.84	486	(2)	(2)	(2)	(2)
1895	194	(2)	2.90	563	(2)	(2)	(2)	(2)
1896	192	(2)	2.94	564	11.9	(2)	(2)	(2)
1897	196	(2)	3.04	596	15.3	(2)	(2)	(2)
1898	211	(2)	3.09	651	19.5	(2)	(2)	(2)
1899	234	46	3.05	713	22.7	(2)	(2)	(2)
1900	234	43	2.98	697	24.9	(2)	(2)	(2)
1901	225	35	2.94	664	25.6	(2)	(2)	(2)
1902	230	44	3.06	708	26.8	(2)	(2)	(2)
1903	225	28	3.02	680	27.6	(2)	(2)	(2)
1904	202	44	3.15	637	28.2	(2)	(2)	(2)
1905	211	23	3.24	684	32.8	(2)	(2)	(2)
1906	213	63	3.36	717	34.7	(2)	2.7	(2)
1907	234	14	3.29	769	35.1	(2)	2.9	(2)
1908	193	38	3.34	644	37.0	(2)	3.6	(2)
1909	209	29	3.34	699	37.5	(2)	3.8	(2)
1910	217	89	3.46	751	41.7	(2)	3.8	(2)
1911	211	27	3.50	738	43.9	(2)	(2)	(2)
1912	223	35	3.68	820	46.8	(2)	3.9	(2)
1913	232	36	3.61	837	50.7	(2)	4.6	(2)
1914	195	80	3.71	724	51.8	(2)	4.8	0.3
1915	203	61	3.91	794	55.3	(2)	4.7	.6
1916	230	26	3.90	896	56.9	(2)	4.6	.8
1917	243	17	3.77	915	56.1	(2)	4.6	1.0
1918	249	7	3.78	942	56.7	(2)	3.8	1.4
1919	195	37	3.84	749	60.0	(2)	3.6	1.2
1920	220	22	4.00	881	60.7	(2)	3.3	1.5
1921	149	23	4.20	627	66.4	(2)	3.4	1.2
1922	142	117	4.28	609	64.8	(2)	(2)	2.4
1923	179	20	4.47	801	68.3	0.3	3.8	2.1
1924	171	73	4.56	781	71.5	.7	(2)	2.8
1925	195	30	4.52	884	72.9	1.2	(2)	3.2
1926	215	24	4.50	966	73.8	1.8	(2)	3.0
1927	191	153	4.55	872	74.9	3.3	5.3	3.6
1928	203	83	4.73	959	76.9	4.5	5.7	4.0
1929	219	11	4.85	1,064	78.4	7.4	6.9	3.8
1930	187	43	5.06	948	81.0	10.5	8.3	4.3
1931	160	35	5.30	849	83.2	13.1	9.5	5.0
1932	146	120	5.22	762	84.1	12.3	9.8	6.3
1933	167	30	4.78	797	84.7	12.0	10.4	5.5
1934	178	15	4.40	785	84.1	12.2	11.1	5.8
1935	179	[6] 7	4.50	805	84.2	13.5	12.2	6.4
1936	199	21	4.62	920	84.8	16.3	13.9	6.4
1937	193	[6] 19	4.69	906	(2)	20.2	14.6	7.1
1938	162	13	4.89	790	87.5	26.7	18.2	8.7
1939	178	36	5.25	936	87.9	31.0	20.1	9.6
1940	202	8	5.19	1,049	88.4	35.4	22.2	9.4
1941	216	27	5.20	1,125	89.0	40.7	22.9	10.7
1942	246	7	5.12	1,261	89.7	45.2	24.4	11.6
1943	264	[6] 15	5.38	1,419	90.3	48.9	24.7	12.5
1944	278	[6] 5	5.67	1,575	90.5	52.9	25.6	16.3
1945	261	[6] 9	5.78	1,508	90.8	56.1	25.6	19.0
1946	214	[6] 23	6.30	1,347	90.8	58.3	26.0	21.1
1947	234	[6] 5	6.42	1,504	90.0	60.7	27.7	22.1
1948	217	[6] 16	6.26	1,358	90.7	64.3	30.2	23.3

[2] Data not available.
[4] Percentages for 1890 to 1912, inclusive, are of total production, as a separation of strip and underground production is not available for those years.
[5] For 1906 to 1926, inclusive, these percentages are exclusive of coal cleaned at central washeries operated by consumers.
[6] Bureau of Labor Statistics, U. S. Department of Labor.

TABLE 14.—Growth of strip mining at bituminous-coal and lignite mines in the United States, 1914–48

Year	Production (thousand net tons)			Percent of total mined by stripping	Average tons per man per day			Average value per ton, f. o. b. mine			Number of strip mines	Number of power shovels and draglines
	Strip mines	Under-ground mines	Total		Strip mines [1]	Under-ground mines [2]	Total	Strip mines [1]	Under-ground mines [2]	Total		
1914	1,281	421,423	422,704	0.3	5.06	3.71	3.71	(3)	(3)	$1.17	[4] 35	48
1915	2,832	439,792	442,624	.6	5.81	3.90	3.91	$1.18	$1.13	1.13	[4] 60	87
1916	3,933	498,587	502,520	.8	6.67	3.88	3.90	1.51	1.32	1.32	[4] 79	111
1917	5,790	546,001	551,791	1.0	6.52	3.75	3.77	2.34	2.26	2.26	[4] 126	182
1918	8,288	571,098	579,386	1.4	6.81	3.76	3.78	2.54	2.58	2.58	[4] 165	276
1919	5,635	460,225	465,860	1.2	6.21	3.82	3.84	2.33	2.49	2.49	[4] 168	287
1920	8,860	559,807	568,667	1.5	7.20	3.97	4.00	4.12	3.74	3.75	[4] 174	312
1921	5,057	410,865	415,922	1.2	8.28	4.18	4.20	2.87	2.89	2.89	[4] 155	279
1922	10,200	412,069	422,268	2.4	8.09	4.24	4.28	3.07	3.02	3.02	272	379
1923	11,940	552,625	564,565	2.1	9.32	4.43	4.47	2.31	2.69	2.68	263	442
1924	13,607	470,080	483,687	2.8	9.91	4.50	4.56	2.00	2.20	2.20	234	420
1925	16,871	503,182	520,053	3.2	11.18	4.45	4.52	1.84	2.05	2.04	227	389
1926	16,923	556,444	573,367	3.0	11.13	4.42	4.50	1.89	2.07	2.06	237	410
1927	18,378	499,385	517,763	3.6	11.06	4.47	4.55	1.90	1.99	1.99	255	455
1928	19,789	480,956	500,745	4.0	13.02	4.61	4.73	1.69	1.87	1.86	250	415
1929	20,268	514,721	534,989	3.8	14.08	4.73	4.85	1.57	1.79	1.78	200	411
1930	19,842	447,684	467,526	4.3	16.21	4.93	5.06	1.54	1.71	1.70	218	341
1931	18,932	363,157	382,089	5.0	17.68	5.12	5.30	1.51	1.54	1.54	235	314
1932	19,641	290,069	309,710	6.3	16.95	4.99	5.22	1.32	1.31	1.31	255	332
1933	18,270	315,360	333,630	5.5	13.59	4.60	4.78	1.33	1.34	1.34	89	389
1934	20,790	338,578	359,368	5.8	13.28	4.23	4.40	1.49	1.76	1.75	344	458
1935	23,647	348,726	372,373	6.4	12.01	4.32	4.50	1.47	1.79	1.77	368	507
1936	28,126	410,962	439,088	6.4	13.91	4.42	4.62	1.49	1.77	1.76	381	562
1937	31,751	413,780	445,531	7.1	(3)	(3)	4.69	(3)	(3)	1.94	449	(3)
1938	30,407	318,138	348,545	8.7	15.00	4.60	4.89	(3)	(3)	1.95	465	737
1939	37,722	357,133	394,855	9.6	14.68	4.92	5.25	1.49	1.88	1.84	537	914
1940	43,167	417,604	460,771	9.4	15.63	4.86	5.09	1.56	1.94	1.91	638	1,071
1941	55,071	459,078	514,149	10.7	15.59	4.83	5.20	1.79	2.23	2.19	769	1,321
1942	67,203	515,490	582,693	11.5	15.52	4.74	5.12	1.90	2.41	2.36	834	1,438
1943	79,685	510,492	590,177	13.5	15.15	4.89	5.38	2.28	2.75	2.69	1,004	1,839
1944	100,898	518,678	619,576	16.3	15.89	5.04	5.67	2.48	3.01	2.92	1,240	2,312

1945	109,987	467,630	577,617	19.0	15.46	5.04	5.78	2.65	3.16	3.06	1,370	2,439
1946	112,964	420,958	533,922	21.1	15.73	5.43	6.30	2.87	3.59	3.44	1,445	2,744
1947	139,395	491,229	630,624	22.1	15.93	5.49	6.42	3.47	4.35	4.16	1,750	3,254
1948	139,506	460,012	599,518	23.3	15.28	5.31	6.26	4.11	5.26	4.99	1,971	3,712

[1] Includes power strip pits proper and excludes horse stripping operations and mines combining stripping and underground in the same operation for the years 1914–42, inclusive. The years 1943–48, inclusive, include data, on all strip mines.

[2] Computed by deducting "Strip mines" data from "Total."

[3] Data not available.

[4] Exclusive of horse stripping operations.

TABLE 15.—Growth of mechanical loading at underground bituminous-coal and lignite mines in the United States, 1923–48

[Production in thousands of net tons]

Year	Underground production mechanically loaded: Loaded by machines: Mobile loading machines	Loaded by machines: Scrapers	Loaded by machines: Conveyors equipped with duck-bills or other self-loading heads	Loaded by machines: Total	Handled by conveyors: Pit-car loaders	Handled by conveyors: Hand-loaded conveyors	Handled by conveyors: Total	Total mechanically loaded	Total underground production	Percent of underground production mechanically loaded	Number of mechanical loading units in actual use: Mobile loading machines	Scrapers	Conveyors equipped with duck-bills or other self-loading heads	Pit-car loaders	Hand-loaded conveyors	Total all types
1923	(1)	(1)	(1)	(1)	(1)	(1)	(1)	[2] 1,880	552,625	[2] 0.3	(1)	(1)	(1)	(1)	(1)	(1)
1924	(1)	(1)	(1)	(1)	(1)	(1)	(1)	[2] 3,496	470,080	[2] .7	(1)	(1)	(1)	(1)	(1)	(1)
1925	(1)	(1)	(1)	(1)	(1)	(1)	(1)	[2] 6,243	503,182	[2] 1.2	(1)	(1)	(1)	(1)	(1)	(1)
1926	7,786	1,554	682	10,022	523	(1)	(1)	[2] 10,545	556,444	[2] 1.8	205	133	27	(1)	(1)	(1)
1927	(1)	(1)	(1)	(1)	(1)	(1)	(1)	16,500	499,385	3.3	(1)	(1)	(1)	(1)	(1)	(1)
1928	11,811	1,548	1,200	14,559	4,117	2,883	7,000	21,559	480,956	4.5	397	130	82	1,040	(1)	(1)
1929	16,432	1,550	1,309	19,291	14,979	3,592	18,571	37,862	514,721	7.4	488	126	99	2,521	(1)	(1)
1930	20,073	1,637	1,628	23,338	19,116	4,528	23,644	46,982	447,684	10.5	545	150	140	2,870	(1)	(1)
1931	19,407	1,471	1,811	22,689	19,172	5,701	24,873	47,562	363,157	13.1	583	146	165	3,428	(1)	(1)
1932	14,825	1,132	1,630	17,587	12,590	5,640	18,230	35,817	290,069	12.3	548	128	159	3,112	(1)	(1)
1933	17,865	991	1,656	20,512	11,413	5,896	17,309	37,821	315,360	12.0	523	93	132	2,453	525	3,726
1934	20,750	1,004	2,082	23,836	11,089	6,508	17,597	41,433	338,578	12.2	534	119	157	2,288	574	3,672
1935	24,675	1,118	2,595	28,388	11,098	7,691	18,789	47,177	348,726	13.5	657	78	179	2,098	670	3,682
1936	40,970	1,273	3,240	45,483	10,538	10,956	21,494	66,977	410,962	16.3	980	106	234	1,851	936	4,107
1937	(1)	(1)	(1)	(1)	(1)	(1)	(1)	83,500	413,780	20.2	(1)	(1)	(1)	(1)	(1)	(1)
1938	57,824	1,031	4,248	63,103	5,653	16,337	21,990	85,093	318,138	26.7	1,405	117	346	1,392	1,526	4,786
1939	76,442	1,007	6,759	84,208	5,038	21,466	26,504	110,712	357,133	31.0	1,573	131	559	873	1,834	4,970
1940	100,962	1,255	10,362	112,579	3,979	31,312	35,291	147,870	417,604	35.4	1,720	116	656	697	2,263	5,452
1941	126,478	1,290	14,918	142,686	3,447	40,534	43,981	186,667	459,078	40.7	1,985	109	788	607	2,807	6,296
1942	160,301	1,405	20,683	182,389	3,252	47,262	50,514	232,903	515,490	45.2	2,301	93	1,062	481	3,041	6,978
1943	179,008	1,349	22,917	203,274	2,669	43,862	46,531	249,805	510,492	48.9	2,525	83	1,226	321	3,191	7,346
1944	202,875	1,341	23,164	227,380	1,835	44,974	46,809	274,189	518,678	52.9	2,737	87	1,331	241	3,236	7,632
1945	198,668	1,252	21,506	221,426	986	40,100	41,086	262,512	467,630	56.1	2,950	87	1,383	142	3,385	7,947
1946	186,975	917	19,678	207,570	623	37,148	37,771	245,341	420,958	58.3	3,200	75	1,521	93	3,470	8,359
1947	229,836	854	21,921	252,611	353	45,193	45,546	298,157	491,229	60.7	3,569	67	1,531	71	3,979	9,217
1948	232,667	743	19,634	253,044	184	42,578	42,762	295,806	460,012	64.3	3,980	56	1,632	37	4,125	9,830

[1] Data not available.
[2] Exclusive of tonnage "Handled by conveyors."

TABLE 16.—Bituminous coal mechanically cleaned in the United States, by types of equipment, 1927–48

[Includes coal cleaned at plants operated by consumers at central washeries in Colorado and Pennsylvania]

Year	Wet methods								Pneumatic methods	Total
	Jigs	Concentrating tables	Classifiers	Launders	Dense media	Jigs and tables	Other combinations [1]	Total		
	THOUSANDS OF NET TONS OF CLEAN COAL									
1927	18,741	3,200	(2)	[3] 1,000	(2)	300	800	24,041	3,651	27,692
1928	17,927	3,412	(2)	[3] 2,446	(2)	1,058	156	24,997	3,786	28,783
1929	18,915	3,532	(2)	[3] 7,103	(2)	1,214	191	30,955	5,844	36,799
1930	17,724	2,272	(2)	[3] 9,818	(2)	1,029	62	30,905	7,895	38,800
1931	13,957	1,551	(2)	[3] 11,213	(2)	926	11	27,658	8,514	36,172
1932	9,968	821	(2)	[3] 12,140	(2)	806	9	23,739	6,539	30,278
1933	11,895	1,119	(2)	[3] 13,272	(2)	693	5	26,984	7,574	34,558
1934	14,012	1,116	(2)	[3] 15,168	(2)	1,227	6	31,529	8,298	39,827
1935	15,735	1,118	(2)	[3] 18,454	(2)	1,549	----------	36,856	8,505	45,361
1936	23,417	1,843	(2)	[3] 22,631	(2)	2,613	----------	50,504	10,591	61,095
1937	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	65,000
1938	27,615	984	4,521	10,681	4,450	2,791	2,145	53,187	10,268	63,455
1939	37,056	1,402	5,917	12,809	4,683	3,256	2,611	67,734	11,695	79,429
1940	47,064	2,830	7,762	16,269	6,692	2,765	4,408	87,290	14,980	102,270
1941	53,287	2,510	8,177	16,954	9,344	4,364	5,742	100,378	17,162	117,540
1942	66,876	3,138	10,529	18,658	12,495	4,366	5,938	122,000	20,187	142,187
1943	66,092	2,929	11,854	17,424	13,388	4,322	8,366	124,375	21,201	145,576
1944	74,175	2,753	14,780	19,686	13,869	4,649	8,751	138,663	20,064	158,727
1945	68,609	2,594	14,203	18,980	12,875	4,754	8,455	130,470	17,416	147,886
1946	64,702	1,447	13,883	16,021	14,173	3,776	8,057	122,059	16,611	138,670
1947	85,931	2,980	14,648	17,902	17,702	4,303	12,617	156,083	18,353	174,436
1948	87,506	4,360	18,304	16,788	20,638	5,252	11,816	164,664	16,216	180,880

See footnotes at end of table.

TABLE 16.—Bituminous coal mechanically cleaned in the United States, by types of equipment, 1927–48—Continued

[Includes coal cleaned at plants operated by consumers at central washeries in Colorado and Pennsylvania]

Year	Wet methods								Pneumatic methods	Total
	Jigs	Concentrating tables	Classifiers	Launders	Dense media	Jigs and tables	Other combinations [1]	Total		
PERCENT CLEANED BY EACH TYPE										
1927	67.6	11.6	(2)	[2] 3.6	(2)	1.1	2.9	86.8	13.2	100.0
1928	62.3	11.8	(2)	[2] 8.5	(2)	3.7	.5	86.8	13.2	100.0
1929	51.4	9.6	(2)	[2] 19.3	(2)	3.3	.5	84.1	15.9	100.0
1930	45.6	5.9	(2)	[2] 25.3	(2)	2.7	.2	79.7	20.3	100.0
1931	38.6	4.3	(2)	[2] 31.0	(2)	2.6	(4)	76.5	23.5	100.0
1932	32.8	2.7	(2)	[2] 40.2	(2)	2.7	(4)	78.4	21.6	100.0
1933	34.4	3.2	(2)	[2] 38.5	(2)	2.0	(4)	78.1	21.9	100.0
1934	35.2	2.8	(2)	[2] 38.1	(2)	3.1	(4)	79.2	20.8	100.0
1935	34.7	2.5	(2)	[2] 40.7	(2)	3.4	----------	81.3	18.7	100.0
1936	38.3	3.0	(2)	[2] 37.1	(2)	4.3	----------	82.7	17.3	100.0
1937	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	----------
1938	43.5	1.6	7.1	16.8	7.0	4.4	3.4	83.8	16.2	100.0
1939	46.6	1.8	7.5	16.1	5.9	4.1	3.3	85.3	14.7	100.0
1940	46.0	2.3	7.6	15.9	6.5	2.7	4.3	85.3	14.7	100.0
1941	45.3	2.2	7.0	14.4	7.9	3.7	4.9	85.4	14.6	100.0
1942	47.0	2.2	7.4	13.1	8.8	3.1	4.2	85.8	14.2	100.0
1943	45.4	2.0	8.1	12.0	9.2	3.0	5.7	85.4	14.6	100.0
1944	46.7	1.8	9.3	12.4	8.8	2.9	5.5	87.4	12.6	100.0
1945	46.4	1.8	9.6	12.8	8.7	3.2	5.7	88.2	11.8	100.0
1946	46.7	1.0	10.0	11.6	10.2	2.7	5.8	88.0	12.0	100.0
1947	49.3	1.7	8.4	10.3	10.1	2.5	7.2	89.5	10.5	100.0
1948	48.4	2.4	10.1	9.3	11.4	2.9	6.5	91.0	9.0	100.0

[1] Includes some "Unspecified."
[2] Launders include classifiers and dense media for the years 1927–36, inclusive.
[3] Data not available.
[4] Less than 0.05 percent.

TABLE 17.—Method of mining at bituminous-coal mines in the United States served by cleaning plants, 1933–48 [1]

Year	Strip mines			Underground mines						Total all mines		
				Mechanical loading			Hand-loading					
	Total production, thousand tons	Production from mines with cleaning plants		Production mechanically loaded, thousand tons	Production from mines with cleaning plants		Production hand-loaded, thousand tons	Production from mines with cleaning plants		Grand total production, thousand tons	Production from mines with cleaning plants	
		Thousand tons	Percent of total		Thousand tons	Percent of total		Thousand tons	Percent of total		Thousand tons	Percent of total
1933	18,270	3,940	21.6	37,821	9,253	24.5	277,539	51,603	18.6	333,630	64,796	19.4
1934	20,790	7,128	34.3	41,433	10,129	24.4	297,145	59,052	19.9	359,368	76,309	21.2
1935	23,647	9,314	39.4	47,177	15,066	31.9	301,549	62,786	20.8	372,373	87,166	23.4
1936	28,126	10,953	38.9	66,977	23,462	35.0	343,985	80,987	23.5	439,088	115,402	26.3
1937	31,751	(2)	(2)	83,500	(2)	(2)	330,280	(2)	(2)	445,531	(2)	(2)
1938	30,407	15,214	50.0	85,093	37,195	43.7	233,045	55,829	24.0	348,545	108,238	31.1
1939	37,722	17,960	47.6	110,712	53,496	48.3	246,421	61,858	25.1	394,855	133,314	33.8
1940	43,167	20,030	46.4	147,870	66,148	44.7	269,734	75,558	28.0	460,771	161,736	35.1
1941	55,071	24,773	45.0	186,667	93,374	50.0	272,411	67,321	24.7	514,149	185,468	36.1
1942	67,203	28,597	42.6	232,903	118,917	51.1	282,587	70,560	25.0	582,693	218,074	37.4
1943	79,685	30,326	38.1	249,805	125,314	50.2	260,687	67,258	25.8	590,177	222,898	37.8
1944	100,898	32,444	32.2	274,189	137,927	50.3	244,489	62,565	25.6	619,576	232,936	37.6
1945	109,987	35,910	32.6	262,512	129,733	49.4	205,118	48,615	23.7	577,617	214,258	37.1
1946	112,964	33,222	29.4	245,341	125,521	51.2	175,617	41,531	23.6	533,922	200,274	37.5
1947	139,395	42,017	30.1	298,157	158,507	53.2	193,072	43,988	22.8	630,624	244,512	38.8
1948	139,506	44,305	31.8	295,806	171,346	57.9	164,206	36,061	22.0	599,518	251,712	42.0

[1] Does not include any estimate for mines that may ship to consumer-operated plants.
[2] Data not available.

TABLE 18.—Number of mines, production, value, employment, days active, man-days, and output per day at bituminous-coal and lignite mines in the United States, by States, in 1948

[Exclusive of mines producing less than 1,000 tons]

State	Number of active mines	Disposition of coal produced (net tons)					Average value per ton[3]	Average number of men working daily				Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Shipped by rail or water[1]	Trucked to railroad or waterway for further shipment	Shipped by truck	Used at mine[2]	Total quantity		Underground	Surface: In strip pits	Surface: All others	Total			
Alabama	484	14,798,104	1,298,900	2,042,854	661,096	18,800,954	$6.15	18,245	689	3,589	22,523	221	4,986,876	3.77
Alaska	5	294,832		108,917	4,157	407,906	6.84	142	34	60	236	294	69,463	5.87
Arizona	1			4,599		4,599	5.26	8			8	247	1,972	2.33
Arkansas	65	1,292,755	343,287	20,881	5,264	1,662,187	7.75	1,844	246	412	2,502	180	450,291	3.69
California (lignite)	1			1,450		1,450	10.00		4		4	82	328	4.42
Colorado	175	3,610,002	515,622	1,333,491	171,671	5,630,786	4.94	4,431	67	1,128	5,626	191	1,076,166	5.23
Georgia	1	20,000				20,000	6.19	39		6	45	198	8,910	2.24
Illinois	266	55,975,796	1,225,284	6,932,289	1,208,720	65,342,089	3.88	21,934	1,962	8,165	32,061	228	7,312,872	8.94
Indiana	111	21,003,360	408,967	1,906,246	530,684	23,849,257	4.04	5,599	2,277	2,550	10,426	215	2,239,569	10.65
Iowa	132	498,184	213,502	951,772	6,698	1,670,156	4.20	1,211	308	246	1,765	185	326,325	5.12
Kansas	65	2,288,074	68,210	173,396	8,360	2,538,040	3.80	395	544	347	1,286	185	238,093	10.66
Kentucky	2,516	56,780,388	13,972,479	10,690,684	640,388	82,083,939	5.41	55,299	2,387	11,401	69,087	194	13,434,076	6.11
Maryland	119	911,542	336,594	403,710	9,318	1,661,164	5.26	1,428	281	296	2,005	177	355,885	4.67
Michigan	1			12,178	842	13,020	6.91	26		6	32	174	5,568	2.34
Missouri	81	3,161,398	134,020	721,656	5,414	4,022,488	3.90	734	535	502	1,771	212	376,204	10.69
Montana:														
Bituminous	17	2,770,395	28,296	53,562	7,677	2,859,930	2.20	497	71	251	819	206	168,413	16.98
Lignite	7			37,571	89	37,660	3.30	26	2	8	36	175	6,295	5.98
Total Montana	24	2,770,395	28,296	91,133	7,766	2,897,590	2.22	523	73	259	855	204	174,708	16.59
New Mexico	17	1,255,557	22,953	43,811	41,611	1,363,932	5.09	948		244	1,192	231	275,736	4.95
North Dakota (lignite)	41	2,399,465	7,454	472,586	81,484	2,960,989	2.27	135	239	246	620	260	161,388	18.35
Ohio	697	25,480,168	4,680,640	8,279,095	268,375	38,708,278	4.01	13,359	4,092	4,335	21,786	206	4,497,919	8.61
Oklahoma	86	2,714,081	585,581	153,981	8,541	3,462,184	4.80	1,524	559	504	2,587	188	486,324	7.12
Pennsylvania	2,220	85,398,114	21,356,413	19,341,770	8,445,960	134,542,257	4.94	78,358	11,057	16,395	105,810	221	23,366,471	5.76
South Dakota (lignite)	2		7,996	21,098		29,094	2.96		16	2	18	212	3,820	7.62
Tennessee	156	5,375,556	329,055	728,893	49,525	6,483,029	5.74	5,576	327	949	6,852	196	1,344,378	4.82
Texas (lignite)	1	56,693				56,693	1.02		10	6	16	265	4,240	13.37
Utah	54	6,037,729	119,374	473,566	182,681	6,813,350	4.56	3,420		1,149	4,569	222	1,014,605	6.72
Virginia	247	15,835,181	2,045,876	286,138	332,210	17,999,405	6.01	14,217	404	2,626	17,247	225	3,875,535	4.64
Washington	39	892,613	49,327	251,274	26,689	1,219,903	6.47	887	102	290	1,279	231	295,024	4.13
West Virginia	1,423	149,537,314	13,164,215	2,660,708	3,499,509	168,861,746	5.53	96,683	5,817	22,452	124,952	228	28,501,332	5.92
Wyoming	49	6,108,834	18,483	152,261	132,166	6,411,744	3.74	3,327	145	999	4,471	183	819,317	7.83
Total	9,079	463,996,135	60,932,528	58,260,437	16,329,129	599,518,229	4.99	330,292	32,175	79,164	441,631	217	95,703,395	6.26

[1] Includes coal loaded at mine directly into railroad cars or river barges.

[2] Includes coal used by mine employees, taken by locomotive tenders at tipple, used at mine for power and heat, coal transported from mine to point of use by conveyor or tram, coal made into beehive coke at mine, and all other uses at mine.

[3] Value received or charged for coal, f. o. b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked [not coke] as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

PRODUCTION BY WEEKS AND MONTHS

TABLE 19.—Bituminous-coal and lignite production (final figures) in the United States in 1948, with estimates by weeks

Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)	Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 3	[1] 4,737,000	[1] 2.2	[2] 2,256,000	July 3	3,714,000	6	619,000
Jan. 10	14,403,000	6	2,401,000	July 10	9,925,000	5	1,985,000
Jan. 17	13,654,000	6	2,276,000	July 17	12,378,000	6	2,063,000
Jan. 24	12,714,000	6	2,119,000	July 24	12,440,000	6	2,073,000
Jan. 31	11,652,000	6	1,942,000	July 31	12,668,000	6	2,111,000
Feb. 7	11,893,000	6	1,982,000	Aug. 7	12,292,000	6	2,049,000
Feb. 14	11,763,000	6	1,961,000	Aug. 14	12,681,000	6	2,114,000
Feb. 21	13,591,000	6	2,265,000	Aug. 21	12,505,000	6	2,084,000
Feb. 28	13,633,000	6	2,272,000	Aug. 28	12,335,000	6	2,056,000
Mar. 6	13,292,000	6	2,215,000	Sept. 4	12,373,000	6	2,062,000
Mar. 13	13,569,000	6	2,262,000	Sept. 11	11,292,000	5	2,258,000
Mar. 20	4,451,000	6	742,000	Sept. 18	12,326,000	6	2,054,000
Mar. 27	2,187,000	6	365,000	Sept. 25	12,340,000	6	2,057,000
Apr. 3	2,148,000	6	358,000	Oct. 2	12,173,000	6	2,029,000
Apr. 10	2,493,000	6	416,000	Oct. 9	12,449,000	6	2,075,000
Apr. 17	7,893,000	6	1,316,000	Oct. 16	12,577,000	6	2,096,000
Apr. 24	11,800,000	6	1,967,000	Oct. 23	12,643,000	6	2,107,000
May 1	14,113,000	6	2,352,000	Oct. 30	12,922,000	6	2,154,000
May 8	12,858,000	6	2,143,000	Nov. 6	10,800,000	5.3	2,038,000
May 15	13,379,000	6	2,230,000	Nov. 13	12,481,000	5.7	2,190,000
May 22	13,848,000	6	2,308,000	Nov. 20	12,468,000	6	2,078,000
May 29	13,805,000	6	2,301,000	Nov. 27	10,488,000	5	2,098,000
June 5	13,121,000	5.5	2,386,000	Dec. 4	11,812,000	6	1,969,000
June 12	13,461,000	6	2,244,000	Dec. 11	12,249,000	6	2,042,000
June 19	13,512,000	6	2,252,000	Dec. 18	11,593,000	6	1,932,000
June 26	12,891,000	6	2,149,000	Dec. 25	9,779,000	5	1,956,000
				Jan. 1, 1949	[1] 8,954,000	[1] 5	[2] 1,770,000
				Total	599,518,000	307.7	1,948,000

[1] Figures represent output and number of working days in that part of week included in the calendar year shown. Total production for the week ended Jan. 3, 1948, was 11,733,000 net tons; week ended Jan. 1, 1949, was 9,029,000 net tons.
[2] Average daily production for entire week and not for working days in the calendar year shown.

TABLE 20.—Bituminous-coal and lignite production (final figures) in the United States in 1948, with estimates by months

Month	Production (net tons)	Number of working days	Average production per working day (net tons)	Month	Production (net tons)	Number of working days	Average production per working day (net tons)
January	57,160,000	26.2	2,182,000	August	54,293,000	26	2,088,000
February	50,880,000	24	2,120,000	September	52,678,000	25	2,107,000
March	34,693,000	27	1,285,000	October	53,936,000	26	2,074,000
April	35,407,000	26	1,362,000	November	50,239,000	24	2,093,000
May	57,144,000	25.5	2,241,000	December	50,385,000	26	1,938,000
June	53,677,000	26	2,065,000				
July	49,025,000	26	1,886,000	Total	599,518,000	307.7	1,948,000

TABLE 21.—Coal production in the United States in 1948, by States (final figures), with estimates by months, in thousands of net tons

[Totals for year are based on final complete returns from all operators known to have produced 1,000 tons and over per year. In most cases monthly apportionment is based on current records of railway carloadings and waterway shipments; in some States upon direct tonnage reports by operators to State mine departments]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	1,963	1,678	1,004	1,004	1,992	1,795	1,453	1,394	1,610	1,641	1,542	1,725	18,801
Alaska	42	43	46	30	24	24	17	19	32	43	43	45	408
Arkansas	104	157	104	74	122	131	131	138	140	162	153	156	1,662
Colorado	720	648	396	296	421	382	245	398	470	491	584	580	5,631
Illinois	6,270	5.887	4.065	4,133	5.701	5,387	5,150	5,700	5.382	6,060	5,705	5.902	65,342
Indiana	2,336	2,287	1,232	1,236	2,271	2,078	1,802	2,073	2,044	2,158	2,066	2,266	23,849
Iowa	146	122	129	134	125	95	113	125	124	187	179	191	1,670
Kansas	252	222	177	161	204	189	169	206	214	238	243	263	2,538
Kentucky:													
Eastern	5,786	5,320	3,237	3,495	6.285	5.878	5,166	5.905	5,215	4,940	4,440	4,020	59.687
Western	2,150	1.895	1,762	1,964	1.985	2,037	2,108	1,908	1,718	1,697	1,535	1,638	22,397
Total Kentucky	7,936	7,215	4,999	5,459	8,270	7,915	7,274	7,813	6,933	6,637	5,975	5,658	82.084
Maryland	165	134	119	159	183	164	170	120	133	108	88	118	1,661
Missouri	410	362	287	261	332	204	274	335	346	388	395	428	4,022
Montana:													
Bituminous	275	259	278	198	212	195	224	228	242	247	254	248	2,860
Lignite	4	3	4	2	3	3	3	3	3	3	3	4	38
Total Montana	279	262	282	200	215	198	227	231	245	250	257	252	2,898
New Mexico	143	128	74	75	137	121	101	134	125	102	104	120	1,364
North Dakota (lignite)	306	277	247	176	128	131	147	159	257	379	362	392	2.961
Ohio	3,698	3,059	2,436	2,414	3.727	3,810	2,734	3,522	3,440	3,478	3,350	3,040	38.708
Oklahoma	376	304	258	270	280	257	260	264	272	318	298	305	3.462
Pennsylvania (bituminous)	12,434	10,989	8,162	7,664	13,005	12,672	10,718	12,572	12,132	12,130	10,609	11,455	134,542
South Dakota (lignite)	3	3	3	2	2	2	2	2	2	3	3	2	29
Tennessee	620	592	349	202	635	576	589	659	592	584	499	496	6,483
Texas (lignite)	6	6	6	5	5	3	3	3	5	5	5	5	57
Utah	793	680	330	252	722	576	515	550	556	542	621	676	6,813
Virginia	1,641	1,371	990	1,239	1,932	1,760	1,786	1,712	1,473	1,427	1,372	1,296	17,999
Washington	126	120	69	79	111	103	78	102	107	107	116	102	1,220
West Virginia	15,657	13,680	8,576	9,402	16,063	14,613	14,711	15,568	15,520	15.878	15,012	14,182	168.862
Wyoming	640	650	349	388	533	489	354	492	521	616	654	726	6,412
Other States [1]	4	4	4	2	4	2	2	2	4	4	4	4	40
Total bituminous coal and lignite	57,160	50.880	34,693	35,407	57,144	53.677	49,025	54.293	52,679	53,936	50,239	50,385	599,518
Pennsylvania anthracite	4,929	4,682	4,935	4,445	4,874	4.597	4,372	5,129	5,015	4,969	4,687	4,506	57,140
Grand total 1948	62,089	55,562	39,628	39.852	62,018	58,274	53,397	59.422	57,694	58,905	54,926	54,891	656,658

[1] Comprises Arizona, California, Georgia, and Michigan.

TABLE 22.—Number and production of bituminous-coal and lignite mines in the United States, classified by size of output in each State, in 1948

[Exclusive of mines producing less than 1,000 tons]

State	Class 1A—500,000 tons and over				Class 1B—200,000 to 500,000 tons				Class 2—100,000 to 200,000 tons			
	Mines		Production		Mines		Production		Mines		Production	
	Number	Percent	Net tons	Percent	Number	Percent	Net tons	Percent	Number	Percent	Net tons	Percent
Alabama	7	1.4	4,826,453	25.7	17	3.5	5,679,694	30.2	22	4.5	3,263,682	17.4
Alaska									3	60.0	376,346	92.3
Arizona												
Arkansas									2	3.1	225,043	13.5
Colorado	1	.6	543,300	9.6	1	.6	290,507	5.2	14	8.0	2,014,498	35.8
Georgia												
Illinois	53	19.9	50,348,128	77.1	21	7.9	6,969,003	10.7	23	8.6	2,084,423	4.6
Indiana	23	20.7	16,588,400	69.6	9	8.2	3,047,933	12.8	18	16.2	2,544,178	10.7
Iowa					1	.8	215,441	12.9	1	.8	140,065	8.4
Kansas	1	1.5	611,477	24.1	3	4.6	1,075,664	42.4	4	6.2	490,797	19.3
Kentucky	15	.6	13,309,954	16.2	86	3.4	26,609,735	32.4	89	3.5	12,947,448	15.8
Maryland									2	1.7	344,944	20.8
Michigan												
Missouri	2	2.5	1,530,907	38.0	3	3.7	1,227,188	30.5	4	4.9	608,319	15.1
Montana (bituminous)	1	5.9	1,893,080	66.2	1	5.9	432,587	15.1	2	11.8	348,204	12.2
California, Montana, North Dakota, South Dakota, and Texas (lignite)					7	13.5	2,530,897	82.0				
New Mexico					3	17.6	1,015,950	74.5	1	5.9	128,093	9.4
Ohio	18	2.6	14,837,796	38.3	24	3.4	7,330,085	18.9	44	6.3	6,064,597	15.7
Oklahoma					4	4.7	1,246,873	36.0	7	8.1	1,065,512	30.8
Pennsylvania	52	2.3	48,840,985	36.3	84	3.8	25,613,153	19.0	143	6.5	19,543,883	14.5
Tennessee					9	5.8	2,255,233	34.8	16	10.3	2,309,963	35.6
Utah	4	7.4	3,489,290	51.2	6	11.1	2,126,397	31.2	4	7.4	608,568	9.0
Virginia	7	2.8	5,401,864	30.0	19	7.7	6,226,351	34.6	22	8.9	3,183,541	17.6
Washington					1	2.6	227,628	18.7	3	7.7	420,783	34.5
West Virginia	77	5.4	62,886,486	37.2	185	13.0	57,373,567	34.0	149	10.5	21,954,433	13.0
Wyoming	4	8.2	2,710,470	42.3	6	12.2	2,177,128	33.9	7	14.3	1,036,478	16.2
Total 1948	265	2.9	227,818,560	38.0	490	5.4	153,671,414	25.6	580	6.4	82,603,888	13.8

TABLE 22.—Number and production of bituminous-coal and lignite mines in the United States, classified by size of output in each State, in 1948—Continued

[Exclusive of mines producing less than 1,000 tons]

State	Class 3—50,000 to 100,000 tons				Class 4—10,000 to 50,000 tons				Class 5—Less than 10,000 tons				Total		
	Mines		Production		Mines		Production		Mines		Production		Mines	Production (net tons)	
	Number	Percent	Net tons	Percent	Number	Percent	Net tons	Percent	Number	Percent	Net tons	Percent		Total	Average per mine
Alabama	24	5.0	1,697,603	9.0	104	21.5	2,212,331	11.7	310	64.1	1,121,191	6.0	484	18,800,954	38,845
Alaska					2	40.0	31,560	7.7					5	407,906	81,581
Arizona									1	100.0	4,599	100.0	1	4,599	4,599
Arkansas	14	21.5	927,511	55.8	16	24.6	390,603	23.5	33	50.8	119,030	7.2	65	1,662,187	25,572
Colorado	21	12.0	1,516,737	26.9	38	21.7	928,939	16.5	100	57.1	336,805	6.0	175	5,630,786	32,176
Georgia					1	100.0	20,000	100.0					1	20,000	20,000
Illinois	31	11.7	2,187,061	3.3	96	36.1	2,623,922	4.0	42	15.8	228,652	.3	266	65,342,080	245,647
Indiana	15	13.5	1,055,260	4.4	23	20.7	512,778	2.1	23	20.7	100,708	.4	111	23,849,257	214,858
Iowa	1	.7	73,006	4.4	44	33.3	871,519	52.2	85	64.4	370,125	22.1	132	1,670,156	12,653
Kansas					11	16.9	205,260	8.1	46	70.8	154,852	6.1	65	2,538,040	39,047
Kentucky	120	4.8	8,862,995	10.8	683	27.2	12,361,230	15.1	1,523	60.5	7,992,577	9.7	2,516	82,083,939	32,625
Maryland	4	3.4	270,467	16.3	33	27.7	771,136	46.4	80	67.2	274,617	16.5	119	1,661,164	13,959
Michigan					1	100.0	13,020	100.0					1	13,020	13,020
Missouri	2	2.5	120,051	3.0	12	14.8	279,714	7.0	58	71.6	256,309	6.4	81	4,022,488	49,660
Montana (bituminous)	1	5.9	76,838	2.7	4	23.5	84,863	3.0	8	47.0	24,298	.8	17	2,859,930	168,231
California, Montana, North Dakota, South Dakota, and Texas (lignite)	4	7.7	262,207	8.5	7	13.4	142,840	4.6	34	65.4	150,442	4.9	52	3,085,886	59,344
New Mexico	2	11.8	141,929	10.4	3	17.6	46,785	3.4	8	47.1	31,175	2.3	17	1,363,932	80,231
Ohio	59	8.5	4,161,557	10.8	185	26.5	4,820,215	12.5	367	52.7	1,494,028	3.8	697	38,708,278	55,536
Oklahoma	11	12.8	737,333	21.3	13	15.1	220,569	6.4	51	59.3	191,897	5.5	86	3,462,184	40,258
Pennsylvania	233	10.5	16,268,587	12.1	853	38.4	20,187,464	15.0	855	38.5	4,088,185	3.1	2,220	134,542,257	60,605
Tennessee	13	8.3	962,853	14.8	30	19.2	619,583	9.6	88	56.4	335,397	5.2	156	6,483,029	41,558
Utah	1	1.9	97,088	1.4	18	33.3	410,137	6.0	21	38.9	81,870	1.2	54	6,813,350	126,173
Virginia	19	7.7	1,364,817	7.6	58	23.5	1,380,550	7.7	122	49.4	442,282	2.5	247	17,999,405	72,872
Washington	2	5.1	174,645	14.3	12	30.8	292,597	24.0	21	53.8	104,250	8.5	39	1,219,903	31,280
West Virginia	186	13.1	13,358,773	7.9	446	31.3	11,403,452	6.8	380	26.7	1,885,035	1.1	1,423	168,861,746	118,666
Wyoming	5	10.2	300,102	4.7	4	8.2	84,289	1.3	23	46.9	103,277	1.6	49	6,411,744	130,852
Total 1948	768	8.5	54,617,420	9.1	2,697	29.7	60,915,346	10.2	4,279	47.1	19,891,601	3.3	9,079	599,518,229	66,034

METHODS OF RECOVERY

TABLE 23.—Bituminous coal and lignite mined by different methods in the United States, by States, in 1948

State	From underground workings							From strip pits		Grand total production (net tons)
	Cut by hand		Shot from solid		Cut by machines		Total underground (net tons)			
	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of total underground		Net tons	Percent of grand total	
Alabama	401,220	2.4	3,408,589	20.2	13,053,938	77.4	16,863,747	1,937,207	10.3	18,800,954
Alaska			267,429	100.0			267,429	140,477	34.4	407,906
Arizona			4,599	100.0			4,599			4,599
Arkansas	16,908	1.5	67,234	6.0	1,039,131	92.5	1,123,273	538,914	32.4	1,662,187
California (lignite)								1,450	100.0	1,450
Colorado	924,250	17.4	69,430	1.3	4,321,271	81.3	5,314,951	315,835	5.6	5,630,786
Georgia			20,000	100.0			20,000			20,000
Illinois	36,096	.1	1,182,274	2.5	46,539,874	97.4	47,758,244	17,583,845	26.9	65,342,089
Indiana	4,218	.1	221,392	2.2	9,720,757	97.7	9,955,367	13,893,890	58.3	23,849,257
Iowa	50,908	5.8	415,157	47.1	415,965	47.1	882,030	788,126	47.2	1,670,156
Kansas			31,957	19.7	130,041	80.3	161,998	2,376,042	93.6	2,538,040
Kentucky	335,967	.5	15,503,589	22.2	53,859,908	77.3	69,699,464	12,384,475	15.1	82,083,939
Maryland	671,385	55.1			546,694	44.9	1,218,079	443,085	26.7	1,661,164
Michigan					13,020	100.0	13,020			13,020
Missouri	44,316	12.6	16,653	4.8	290,168	82.6	351,137	3,671,351	91.3	4,022,488
Montana (bituminous)			4,684	.5	945,593	99.5	950,277	1,909,653	66.8	2,859,930
Montana (lignite)			36,081	100.0			36,081	1,579	4.2	37,660
New Mexico	18,588	1.4	118,673	8.7	1,226,671	89.9	1,363,932			1,363,932
North Dakota (lignite)			23,036	4.8	461,795	95.2	484,831	2,476,158	83.6	2,960,989
Ohio	59,863	.3	54,350	.3	18,298,859	99.4	18,413,072	20,295,206	52.4	38,708,278
Oklahoma	25,276	2.2	72,463	6.4	1,033,040	91.4	1,130,779	2,331,405	67.3	3,462,184
Pennsylvania	7,135,197	7.2	2,424,221	2.5	89,211,525	90.3	98,770,943	35,771,314	26.6	134,542,257
South Dakota (lignite)								29,094	100.0	29,094
Tennessee	276,015	4.9	600,713	10.7	4,732,583	84.4	5,609,311	873,718	13.5	6,483,029
Texas (lignite)								56,693	100.0	56,693
Utah	4,731	.1	77,536	1.1	6,731,083	98.8	6,813,350			6,813,350
Virginia	80,487	.5	1,005,949	6.1	15,496,782	93.4	16,583,218	1,416,187	7.9	17,999,405
Washington	118,650	12.4	333,001	34.7	507,650	52.9	959,301	260,602	21.4	1,219,903
West Virginia	2,262,940	1.5	4,127,177	2.8	143,521,088	95.7	149,911,205	18,950,541	11.2	168,861,746
Wyoming	4,587	.1	19,999	.4	5,328,085	99.5	5,352,671	1,059,073	16.5	6,411,744
Total 1948	12,471,602	2.7	30,106,186	6.6	417,434,521	90.7	460,012,309	139,505,920	23.3	599,518,229

TABLE 94.—Number of coal-cutting machines in bituminous-coal and lignite mines, average output per machine, and percentage of total product of underground mines cut by machines in the United States, by States, 1947–48

State	1947			1948		
	Number of coal-cutting machines in use	Average output per machine (net tons)	Percent of total product of underground mines cut by machines	Number of coal-cutting machines in use	Average output per machine (net tons)	Percent of total product of underground mines cut by machines
Alabama	605	21,981	77.8	659	19,809	77.4
Arkansas	83	11,757	87.1	93	11,173	92.5
Colorado	495	9,813	79.5	521	8,204	81.3
Illinois	749	63,956	95.5	723	64,371	97.4
Indiana	213	51,659	97.8	243	40,040	97.7
Iowa	62	7,480	49.2	56	7,428	47.2
Kansas	20	7,763	57.3	22	5,911	80.3
Kentucky	1,859	30,638	77.3	1,987	27,106	77.3
Maryland	52	14,066	50.3	55	9,940	44.9
Michigan	3	4,671	100.0	2	6,510	100.
Missouri	50	6,447	82.1	46	6,308	82.6
Montana (bituminous and lignite)	38	29,393	96.3	36	20,266	95.9
New Mexico	64	19,051	84.5	57	21,521	89.9
North Dakota (lignite)	10	44,432	94.1	6	76,966	95.2
Ohio	822	24,360	99.2	822	22,261	99.4
Oklahoma	75	13,942	93.8	76	13,593	91.4
Pennsylvania	3,322	20,091	87.9	3,529	25,280	90.3
Tennessee	253	19,027	83.8	254	18,632	84.4
Utah	231	30,927	96.2	214	31,454	98.8
Virginia	438	40,267	92.7	461	33,616	93.4
Washington	53	8,152	46.9	45	11,281	52.9
West Virginia	3,999	37,076	96.2	4,198	34,188	95.7
Wyoming	369	17,987	97.9	340	15,671	99.5
Total	13,865	31,886	90.0	14,445	28,898	90.7

STRIPPING OPERATIONS

TABLE 25.—Stripping operations in the bituminous-coal and lignite fields of the United States, by States and counties, in 1948 [1]

State and county	Number of strip pits	Number of power shovels and dragline excavators				Mined by stripping (net tons)	Average number of men working daily			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	Diesel	Gasoline		In strip pits	All others	Total			
Alabama:												
Bibb	1					1,221	2		2	55	110	11.10
Blount	8	2	1	2	2	80,851	36	14	50	271	13,525	5.98
Jefferson	9			12	1	309,474	135	65	200	188	37,567	8.24
St. Clair	3			2	4	96,053	48	15	63	238	14,981	6.41
Tuscaloosa	7			13		350,612	106	34	140	250	34,965	10.03
Walker	20		3	52		1,098,896	362	158	520	186	96,901	11.34
Total Alabama	43	2	4	81	7	1,937,207	689	286	975	203	198,049	9.78
Alaska	3			4		140,477	34	12	46	261	12,001	11.71
Arkansas:												
Franklin	3	2			3	25,305	28	9	37	177	6,557	3.86
Johnson	5			8		207,833	67	51	118	158	18,635	11.15
Scott	1			2		72,175	26	10	36	120	4,330	16.67
Sebastian	9	2	1	9	2	233,601	125	38	163	194	31,672	7.38
Total Arkansas	18	4	1	19	5	538,914	246	108	354	173	61,194	8.81
California: Lignite	1					1,450	4		4	82	328	4.42
Colorado:												
Delta	1					1,329	3		3	43	129	10.30
El Paso	1					2,536	5		5	119	595	4.26
Fremont	2			1	1	16,244	7		7	149	1,045	15.54
Huerfano	1			1		56,259	17	7	24	200	4,794	11.74
Jackson	2				1	32,021	15	2	17	190	3,232	9.91
Routt	2		1	1	2	207,446	20	46	66	177	11,656	17.80
Total Colorado	9		1	3	4	315,835	67	55	122	176	21,451	14.72
Illinois:												
Bureau	2		5	2		685,634	60	109	169	268	45,276	15.14
Fulton	10		24	6	1	5,457,689	451	519	970	236	229,115	23.82
Grundy and Will	4		14	4	1	1,835,022	255	229	484	204	127,774	14.36
Hancock	1			2	2	47,077	20	7	27	201	5,435	8.66
Jackson	2		3	2		398,722	71	43	114	211	24,096	16.55
Knox	3		8	1		2,018,347	276	180	456	253	115,500	17.47
LaSalle	2		2	1		84,404	18	16	34	251	8,549	9.87

[1] See footnote at end of table.

TABLE 25.—Stripping operations in the bituminous-coal and lignite fields of the United States, by States and counties, in 1948[1]—Con.

State and county	Number of strip pits	Number of power shovels and dragline excavators				Mined by stripping (net tons)	Average number of men working daily			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	Diesel	Gasoline		In strip pits	All others	Total			
Illinois—Continued												
Livingston	1	----	----	----	1	5,255	5	----	5	110	550	9.55
Perry	3	----	13	2	2	2,798,729	251	414	665	253	168,475	16.61
Randolph	1	----	4	1	----	1,063,583	50	78	128	281	35,951	29.58
St. Clair	3	----	5	3	3	1,028,868	101	87	188	269	50,507	20.37
Saline	2	----	3	4	----	674,373	134	124	258	232	59,760	11.28
Schuyler	1	----	1	1	----	127,308	17	22	39	162	6,336	20.09
Vermilion	2	1	----	2	1	91,211	31	8	39	250	9,747	9.36
Williamson	9	----	5	14	2	1,267,623	222	129	351	177	62,215	20.37
Total Illinois	46	1	87	45	13	17,583,845	1,962	1,965	3,927	242	949,286	18.52
Indiana:												
Clay	10	1	10	16	12	1,892,960	434	153	587	223	131,136	14.44
Daviess	1	----	2	1	----	502,017	48	51	99	273	27,063	18.55
Fountain and Parke	2	----	----	4	2	139,045	50	9	59	257	15,168	9.17
Gibson	1	----	----	1	----	50,000	12	9	21	144	3,032	16.49
Greene	5	----	3	6	2	771,655	109	87	196	194	38,047	20.28
Knox	1	----	2	2	----	802,177	87	112	199	244	48,596	16.51
Owen	1	----	----	----	2	15,401	6	----	6	275	1,650	9.33
Pike	7	1	16	9	1	3,660,786	566	373	939	228	213,721	17.13
Spencer	2	----	----	4	1	160,663	87	22	109	139	15,097	10.64
Sullivan	6	----	9	4	1	1,616,961	233	145	378	251	94,984	17.02
Vermillion	3	----	3	4	----	489,293	87	50	137	243	33,278	14.70
Vigo	3	----	3	2	2	653,838	128	50	178	219	38,993	16.77
Warrick	6	----	15	10	2	3,139,094	430	330	760	250	189,790	16.54
Total Indiana	48	2	63	63	25	13,893,890	2,277	1,391	3,668	232	850,555	16.34
Iowa:												
Jasper	1	----	----	1	----	16,352	4	----	4	257	1,028	15.91
Mahaska	12	----	----	13	9	235,604	98	30	128	242	30,928	7.62
Marion	23	----	1	7	17	440,940	154	36	190	183	34,828	12.66
Monroe	1	----	----	----	----	3,905	4	----	4	221	884	4.42
Van Buren	4	----	----	1	4	26,253	23	6	29	134	3,878	6.77
Wapello	5	----	----	4	1	65,072	25	10	35	223	7,804	8.34
Total Iowa	46	----	1	26	31	788,126	308	82	390	203	79,350	9.93

Kansas:												
Bourbon	4		2		2	147,632	39	21	60	208	12,506	11.80
Cherokee	12	2	5	6	4	888,763	176	101	277	218	60,273	14.75
Crawford	17	6	10	5	3	1,054,312	244	154	398	209	83,162	12.68
Franklin	1					1,024	4		4	40	160	6.40
Labette	2				1	3,664	6		6	167	1,002	3.66
Linn	3		2	1	1	274,670	60	17	77	233	17,965	15.29
Osage	3				1	5,977	15		15	80	1,207	4.95
Total Kansas	42	8	19	12	12	2,376,042	544	293	837	211	176,275	13.48
Kentucky:												
Bell	3	1		7		84,102	54	10	64	158	10,140	8.29
Boyd	3			9		254,909	76	25	101	216	21,845	11.67
Butler	3			2		29,000	14	3	17	139	2,370	12.24
Clay	10			10		103,046	65	17	82	102	8,334	12.36
Crittenden	1					3,973	6	3	9	50	450	8.83
Daviess	2			4		337,000	38	28	66	262	17,300	19.48
Elliott	1	1				1,600	5		5	180	900	1.78
Grayson	2			3		9,211	21	8	29	60	1,740	5.29
Hancock	1			4		180,000	28	20	48	232	11,115	16.19
Harlan	2			2		17,069	19	7	26	98	2,540	6.72
Hopkins	28		19	45	4	6,816,681	745	604	1,349	214	288,219	23.65
Jackson	2				2	5,500	13	6	19	80	1,520	3.62
Knott	2			1		7,178	13	4	17	80	1,358	5.29
Knox	2			5		178,254	43	17	60	248	14,902	11.96
Laurel	7			4		54,148	41	13	54	112	6,049	8.95
Lawrence	1			2		30,181	18	5	23	238	5,474	5.51
Letcher	3			5		207,308	52	13	65	234	15,242	13.60
Magoffin	1			2		43,104	10	4	14	257	3,598	11.98
McCreary	4			2		74,000	40	12	52	189	9,840	7.52
McLean	1				3	26,420	8	5	13	168	2,184	12.10
Morgan	3				4	47,395	28	12	40	159	6,340	7.48
Muhlenberg	10	5	4	21	2	1,530,044	392	127	519	176	91,479	16.82
Ohio	18		5	19	4	1,471,042	368	190	558	153	85,503	17.20
Perry	1		1	2		138,844	40	5	45	178	8,000	17.36
Pike	5			6		257,854	99	30	129	134	17,245	14.95
Pulaski	1			1		18,722	8		8	300	2,400	7.80
Rockcastle	5					10,000	10	5	15	148	2,222	4.50
Webster	5			6	2	390,199	84	26	110	178	19,560	19.95
Whitley	7			6		48,601	49	12	61	150	9,136	5.32
Total Kentucky	120	7	29	168	21	12,384,475	2,387	1,211	3,598	185	667,005	18.57
Maryland:												
Allegany	14			4	9	215,009	131	27	158	133	21,038	10.22
Garrett	15			13	8	228,076	150	40	190	110	20,874	10.93
Total Maryland	29			17	17	443,085	281	67	348	120	41,912	10.57

See footnote at end of table.

TABLE 25.—Stripping operations in the bituminous-coal and lignite fields of the United States, by States and counties, in 1948 [1]—Con.

State and county	Number of strip pits	Number of power shovels and dragline excavators				Mined by stripping (net tons)	Average number of men working daily			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	Diesel	Gasoline		In strip pits	All others	Total			
Missouri:												
Barton	5		4	2	1	348,867	61	39	100	234	23,394	14.91
Bates	4		3		2	719,748	60	69	129	242	31,270	23.02
Boone	1			2		52,405	14	2	16	273	4,362	12.01
Callaway	3			4		149,285	43	13	56	285	15,973	9.35
Dade	3				3	14,313	13		13	270	3,506	4.08
Henry	7		6	3		564,307	88	35	123	268	33,014	17.09
Jasper	1	1				3,487	6		6	205	1,230	2.83
Johnson	1		2	1		185,775	37	16	53	238	12,621	14.72
Macon	2		5			822,928	84	102	186	276	51,392	16.01
Monroe	1				1	5,850	6	2	8	300	2,400	2.44
Ralls	1					1,291	5		5	63	315	4.10
Randolph	1		3			461,924	34	71	105	244	25,620	18.03
St. Clair	2			2		35,110	20	11	31	186	5,780	6.07
Vernon	5	1	4	2	1	306,061	64	38	102	240	24,504	12.49
Total Missouri	37	2	27	16	8	3,671,351	535	398	933	252	235,381	15.60
Montana:												
Bituminous coal:												
Carbon and Rosebud	2		7	2	1	1,909,653	71	24	95	239	22,701	84.12
Lignite	1					1,579	2	2	4	43	172	9.18
Total Montana	3		7	2	1	1,911,232	73	26	99	231	22,873	83.56
North Dakota: Lignite	30		16	9	19	2,476,158	239	195	434	258	112,125	22.08
Ohio:												
Athens	9			17	2	491,328	179	95	274	138	37,911	12.96
Belmont	22		1	32	7	1,578,033	329	109	438	202	88,369	17.86
Carroll	7			7	6	211,721	90	24	114	201	22,897	9.25
Columbiana	29			38	5	1,036,705	264	66	330	234	77,251	13.42
Coshocton	15		2	15	5	550,341	169	42	211	219	46,188	11.92
Gallia	3				2	14,808	24	3	27	66	1,776	8.34
Guernsey	5		2	11		267,243	81	26	107	212	22,717	11.76
Harrison	15		17	37	5	4,970,849	692	412	1,104	234	258,362	19.24
Hocking	3			5	2	62,834	35	15	50	109	5,435	11.56
Holmes	2				2	10,307	7		7	156	1,090	9.46
Jackson	12			7	5	153,521	73	13	86	197	16,963	9.05
Jefferson	36	4	5	54	10	3,129,907	577	264	841	222	186,404	16.79
Lawrence	2			2	2	51,728	15	5	20	181	3,616	14.31
Mahoning	9			17	3	502,213	93	20	113	274	31,000	16.20
Meigs	9			8	4	219,931	82	18	100	187	18,737	11.74

Morgan	2			3	1	38,442	15	3	18	196	3,534	10.88
Muskingum	11		3	16	7	1,718,611	210	63	273	252	68,694	25.02
Noble	10		3	20	4	1,360,008	205	118	323	215	69,323	19.62
Perry	22		7	37	12	1,876,863	364	263	627	218	136,404	13.69
Portage	1			2		103,472	18	8	26	320	8,330	12.42
Scioto	1					4,149	6		6	72	432	9.60
Stark	10			8	19	655,278	147	34	181	277	50,076	13.09
Tuscarawas	23	1	2	24	16	791,842	253	97	350	211	73,793	10.73
Vinton	12			10	2	267,828	109	39	148	232	34,380	7.79
Washington	3			3	1	128,199	38	15	53	155	8,234	15.57
Wayne	1			3		108,955	17	9	26	299	7,774	14.02
Total Ohio	274	5	42	376	122	20,295,206	4,092	1,761	5,853	210	1,279,690	15.86
Oklahoma:												
Coal	3		1	5		225,885	60	29	89	218	19,406	11.64
Craig	4			2		14,301	19	9	28	135	3,787	3.78
Haskell	4	1		4		115,008	50	5	55	236	12,986	8.86
Latimer	1		2			280,182	28	38	66	229	15,114	19.13
Le Flore	6			6	3	237,227	109	48	157	159	24,944	9.51
Muskogee	2	3		1		194,823	63	10	73	291	21,264	9.16
Okmulgee	2		2	2		598,434	53	58	111	253	28,058	21.33
Rogers	5	3	3	4	1	581,253	153	86	239	256	61,218	9.49
Tulsa	1		1	1	1	63,542	20	10	30	152	4,560	13.93
Wagoner	1			1		11,750	4	2	6	118	708	16.60
Total Oklahoma	29	7	9	26	5	2,331,405	559	295	854	225	192,045	12.14
Pennsylvania:												
Allegheny	88			124	23	4,409,757	1,039	340	1,379	201	277,276	15.90
Armstrong	35			59	9	1,997,771	577	192	769	194	148,827	13.42
Beaver	12			18	2	455,798	134	38	172	209	36,006	12.66
Bedford	4			8	5	340,554	142	23	165	220	36,241	9.40
Blair	4			3	1	210,993	63	19	82	178	14,625	14.43
Bradford	1			2		6,644	3		3	291	873	7.61
Butler	28		2	39	13	1,384,720	358	107	465	211	97,939	14.14
Cambria	41			60	8	1,599,590	529	144	673	176	118,117	13.54
Cameron	9				3	20,255	15	1	16	197	3,150	6.43
Centre	22	2		33	7	1,007,921	333	88	421	210	88,571	11.38
Clarion	42			72	18	2,697,342	747	242	989	224	221,954	12.15
Clearfield	129	2		205	38	5,651,934	1,978	585	2,563	197	505,044	11.17
Clinton	8	1		12	1	416,039	127	28	155	193	29,992	13.87
Elk	21			25	2	633,532	320	78	398	153	60,904	10.40
Fayette	70	3		63	26	1,662,139	628	135	763	152	115,896	14.34
Fulton and Huntingdon	5			13	1	263,200	117	28	145	161	23,280	11.31
Greene	7		1	17	1	515,659	170	44	214	180	38,501	13.36
Indiana	57	1		81	19	1,706,123	635	176	811	151	122,348	13.94
Jefferson	41	1		49	22	1,465,189	568	168	736	162	119,473	12.26
Lawrence	6			7	4	221,702	52	14	66	232	15,325	14.47
Lycoming	1			1	1	8,208	7	1	8	162	1,294	6.34

1 See footnote at end of table.

TABLE 25.—Stripping operations in the bituminous-coal and lignite fields of the United States, by States and counties, in 1948 [1]—Con.

State and county	Number of strip pits	Number of power shovels and dragline excavators				Mined by stripping (net tons)	Average number of men working daily			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	Diesel	Gasoline		In strip pits	All others	Total			
Pennsylvania—Continued												
McKean	1					1,488	3		3	100	300	4.96
Mercer	6			10	3	320,224	73	23	96	252	24,193	13.24
Somerset	50		1	87	12	2,205,187	692	206	898	188	169,081	13.04
Tioga	8			5		70,791	30	7	37	193	7,131	9.93
Venango	6			14	6	611,632	106	26	132	280	36,934	16.56
Washington	39	2	6	84	6	4,140,990	848	375	1,223	200	244,817	16.91
Westmoreland	88	1	3	88	21	1,746,923	763	162	925	144	133,008	13.13
Total Pennsylvania	812	13	13	1,179	252	35,771,314	11,057	3,250	14,307	188	2,692,000	13.29
South Dakota: Lignite	2			1	1	20,094	16	2	18	212	3,820	7.62
Tennessee:												
Anderson	1				1	3,000	3		3	120	360	8.33
Campbell	3		2	3	3	291,222	87	19	106	217	22,974	12.68
Claiborne	4			6	1	123,707	59	14	73	196	14,275	8.67
Grundy	1		1	2		108,891	32	7	39	275	10,733	10.15
Marion	1			5	4	204,000	80	20	100	204	20,350	10.02
Scott	2			3		14,371	19	3	22	71	1,556	9.24
Sequatchie	1			2	1	66,631	31	16	47	155	7,280	9.15
Van Buren	1			3	1	61,896	16	6	22	261	5,734	10.79
Total Tennessee	14		3	24	11	873,718	327	85	412	202	83,262	10.49
Texas: Lignite	1				1	56,693	10	6	16	265	4,240	13.37
Virginia:												
Buchanan	10		2	27	1	848,250	243	47	290	213	61,653	13.76
Russell	2			9	1	268,499	61	19	80	247	19,794	13.56
Tazewell	1			3	1	91,452	28	6	34	260	8,829	10.36
Wise	5			4	4	207,986	72	21	93	162	15,044	13.83
Total Virginia	18		2	43	7	1,416,187	404	93	497	212	105,320	13.45
Washington:												
King	4			2	3	152,041	48	21	69	229	15,789	9.63
Kittitas	2		3		2	86,571	41	7	48	207	9,936	8.71
Thurston	1			1	1	21,990	13	2	15	165	2,469	8.91
Total Washington	7		3	3	6	260,602	102	30	132	214	28,194	9.24

West Virginia:												
Barbour	18		2	32	4	1,711,267	312	294	606	161	97,638	17.53
Boone	4			9	1	154,019	67	12	79	178	14,023	10.98
Braxton and Webster	3		2	6		270,253	57	21	78	226	17,589	15.36
Brooke	11			20	2	869,142	248	80	328	178	58,443	14.87
Fayette	31			54	10	1,729,816	594	141	735	172	126,488	13.68
Grant	3			2	2	42,146	28	3	31	118	3,666	11.50
Greenbrier	13	2		25	2	746,966	327	79	406	149	60,542	12.34
Hancock	2			3	2	123,538	33	8	41	183	7,515	16.44
Harrison	59			125	4	4,669,813	1,148	470	1,618	157	254,045	18.38
Kanawha	9		1	5	4	229,039	105	28	133	119	15,775	14.52
Lewis	2			4		166,381	34	13	47	211	9,903	16.80
Logan	7			16		511,265	178	36	214	174	37,161	13.76
Marion	15			7	4	156,444	111	23	134	73	9,840	15.90
McDowell	11			26		589,477	230	49	279	193	53,944	10.93
Mercer	12		1	22		774,184	248	84	332	154	51,045	15.17
Mineral	3			6		105,943	49	13	62	112	6,962	15.22
Mingo	10			21	2	930,649	255	88	343	203	69,659	13.36
Monongalia	20			23	8	911,726	230	67	297	169	50,181	18.17
Nicholas	12			19	4	575,888	230	70	300	154	46,339	12.43
Pocahontas	1			1		19,810	8	4	12	137	1,644	12.05
Preston	12			9	7	361,285	151	78	229	148	33,960	10.64
Putnam	1			2		43,566	18	8	26	105	2,728	15.97
Raleigh	25			25	7	697,705	354	77	431	123	53,172	13.12
Randolph	9			14	6	485,294	159	76	235	134	31,489	15.41
Taylor	10			24	2	870,647	206	66	272	158	43,087	20.21
Tucker	3		1	14		447,280	156	35	191	186	35,609	12.56
Upshur	5			12	2	335,671	70	29	99	193	19,114	17.56
Wayne	2			1		22,871	27	4	31	96	2,973	7.69
Wyoming	9			24	2	398,456	184	54	238	166	39,520	10.08
Total West Virginia	322	2	7	551	75	18,950,541	5,817	2,010	7,827	160	1,254,054	15.11
Wyoming:												
Campbell	1		3			263,266	18	30	48	295	14,169	18.58
Carbon	3	1		3	1	318,028	49	28	77	211	16,237	19.59
Converse	2				1	11,214	5		5	290	1,452	7.72
Sheridan	2			4	1	466,565	73	60	133	211	28,002	16.66
Total Wyoming	8	1	3	7	3	1,059,073	145	118	263	228	59,860	17.69
Total United States 1948	1,971	54	337	2,675	646	139,505,920	32,175	13,739	45,914	199	9,130,360	15.28

[1] On returns from mines combining stripping and underground methods in same operation, tonnage has been separated and figures on employment prorated so that this table includes only data pertaining to strip mining.

POWER DRILLING

TABLE 26.—Number of underground bituminous-coal and lignite mines using power drills for shot holes in 1947–48 and summary of operations, by States, in 1948

State	Number of mines using power drills		1948					
			Number of power drills		Net tons produced in working places where shot holes were power-drilled			Total production from mines using power drills (net tons)
	1947	1948	Electric	Compressed air	Electric drills	Compressed air drills	Total	
Alabama	73	78	851	79	12,775,346	12,296	12,787,642	14,162,073
Alaska	2	2	25	12	120,069	147,360	267,429	267,429
Arkansas	18	17	30	26	184,737	102,071	286,808	896,257
Colorado	91	98	464	50	3,830,737	8,647	3,839,384	4,837,481
Illinois	152	159	1,266	8	46,068,022	4,379	46,072,401	46,242,397
Indiana	31	38	300	1	9,038,917		9,038,917	9,382,920
Iowa	13	13	35	2	257,039	24,269	281,308	281,308
Kansas	1	1	1		11,608		11,608	11,608
Kentucky	962	1,027	2,769	119	53,038,123		53,038,123	65,498,912
Maryland	5	5	31	5	299,878		299,878	428,844
Michigan	1	1	2		6,000		6,000	13,020
Missouri	8	7	10	1	151,749		151,749	170,211
Montana:								
Bituminous	11	11	35	4	914,025		914,025	915,405
Lignite	5	3	9		18,741		18,741	27,178
New Mexico	6	5	39	6	1,138,933		1,138,933	1,151,428
North Dakota (lignite)	8	5	9		466,556		466,556	466,556
Ohio	83	174	623	3	15,109,292		15,109,292	16,060,415
Oklahoma	6	6	32		451,709		451,709	494,376
Pennsylvania	308	372	2,448	485	61,987,552	684,098	62,671,650	80,951,143
Tennessee	33	42	224	20	4,025,255		4,025,255	4,876,022
Utah	39	39	268	5	6,710,368		6,710,368	6,717,319
Virginia	[1] 141	152	446	36	9,711,735	124,484	9,836,219	13,355,895
Washington	22	23	81	148	253,388	655,890	909,278	921,751
West Virginia	475	491	3,495	299	103,191,765	105,808	103,297,573	126,019,071
Wyoming	28	29	477	3	5,239,196	2,714	5,241,910	5,295,275
Total	[1] 2,522	2,798	13,970	1,312	335,000,740	1,872,016	336,872,756	399,442,294

[1] Revised figure.

MINE SIZE AND MECHANIZATION

Production at strip mines and underground mines with mechanical loading increased sharply in the period 1938–47. (See fig. 10.) A great majority of the small mines employ 100 percent hand loading. Figure 11 shows percentage of output classified by size of mines and methods of mining in 1947. Weekly Coal Report 1657 Supplement (June 17, 1949) shows detailed data of bituminous-coal and lignite mines by type of mining and underground loading and size of mines, by States, in 1947.

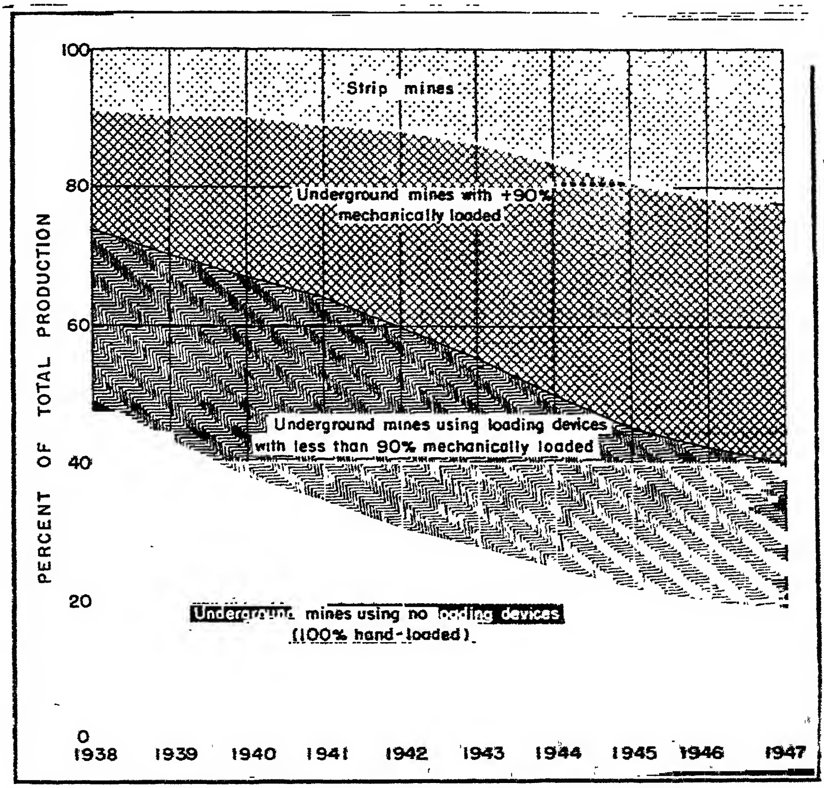

FIGURE 10.—Bituminous-coal and lignite production in the United States, by methods of mining, 1938–47.

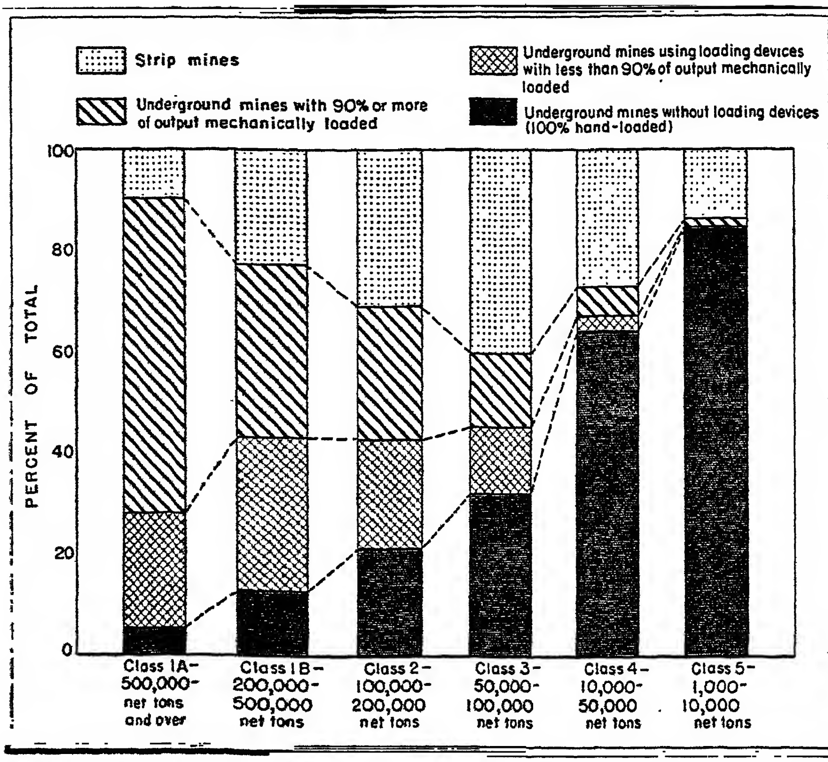

FIGURE 11.—Percentage of bituminous-coal and lignite production in the United States, classified by size of mines and method of mining, in 1947.

MECHANICAL LOADING

Bituminous coal and lignite mechanically loaded in underground mines amounted to 295,806,285 tons in 1948, or 64 percent of the total underground output.

Mechanical loading equipment used in underground bituminous-coal and lignite mines is divided into two types: Devices that virtually eliminate hand shoveling (known as mobile loaders, scrapers, and self-loading conveyors) and those that greatly reduce the labor in hand shoveling (known as hand-loaded face conveyors and pit-car loaders). Devices in the first category are designated "machines" and those in the second category, "conveyors."

A few continuous miners were used in 1948. They are included with mobile loaders in the following tables.

Sales of Mechanical Loading Equipment.—Shipments of mechanical loading equipment for underground use in coal mines in the United States, in terms of capacity, were less in 1949 than in any year since 1935. Table 27 shows the sales of loading equipment reported to bituminous coal and lignite operators, by type of equipment, and the number of manufacturers reporting for 1942–49.

Table 29 compares loading equipment, "mother" conveyors, and shuttle cars in use in bituminous-coal and lignite mines with sales in 1949, by States.

Extent of Mechanical Loading.—More than 78 percent of the underground mechanically loaded tonnage was handled by mobile loaders in 1948. Table 30 shows the tons and percent handled by each type of equipment in 1947 and 1948.

During 1948, in underground bituminous-coal and lignite mines, 3,980 mobile loaders handled 232,667,172 tons, an average of 58,459 tons per mobile loader per year; self-loading conveyors averaged 12,030; scrapers, 13,272; hand-loaded face conveyors, 10,322; and pit-car loaders, 4,971 per unit per year.

Mechanical Loading by States.—West Virginia has been the leading producer of mechanically loaded coal since 1939. During 1948 West Virginia produced 103,755,282 tons of mechanically loaded coal, followed by Pennsylvania with 53,498,497, Illinois with 43,042,416, Kentucky with 31,569,643, and Ohio with 13,389,427 tons. These five States produced 83 percent of the total output of underground mechanically loaded bituminous coal in the United States in 1948.

Detailed data, by States, on the number of mines and machines and the production of mechanically loaded coal compared with the total production at mines using mechanical loading devices are given in table 31. Comparative changes in underground mechanical loading in 1947–48, by States, are shown in table 32.

Table 33 shows bituminous-coal and lignite tonnage mined by stripping, compared with underground hand-loaded and machine-loaded tonnage, also productivity at strip and underground mines, by States, for 1948.

TABLE 27.—Units of mechanical loading equipment sold to bituminous-coal and lignite mines for underground use in the United States, as reported by manufacturers, 1942–49

Type of equipment	1942	1943	1944	1945	1946	1947	1948	1949	Change 1949 from 1948 (percent)
Mobile loaders	352	234	282	349	490	485	[1] 723	[1] 286	−60.4
Scrapers [2]	15	13	20	6	3	12	17	8	−52.9
Conveyors [3]	1,167	798	580	738	838	846	1,025	394	−61.6
Pit-car loaders	2	1		(4)	(4)	(4)	(4)	(4)	
Total	1,536	1,046	882	1,093	1,331	1,343	1,765	688	−61.0
Number of manufacturers reporting	28	24	22	25	24	23	22	22	

[1] Includes continuous miners.
[2] Reported as scrapers or scraper haulers and hoists.
[3] Includes hand-loaded conveyors and those equipped with duckbills or other self-loading heads.
[4] Canvass of sales of pit-car loaders discontinued in 1145.

TABLE 28.—Units of mechanical loading equipment in use in underground bituminous-coal and lignite mines in the United States, 1943–48

Type of equipment	1943	1944	1945	1946	1947	1948	Change 1948 from 1947 (percent)
Mobile loaders	2,525	2,737	2,950	3,200	3,569	3,980	+11.5
Scrapers	83	87	87	75	67	56	−16.4
Pit-car loaders	321	241	142	93	71	37	−47.9
Conveyors equipped with duckbills or other self-loading heads	1,226	1,331	1,383	1,521	1,531	1,632	+6.6
Hand-loaded conveyors	3,191	3,236	3,385	3,470	3,979	4,125	+3.7
Total	7,346	7,632	7,947	8,359	9,217	9,830	+6.7

TABLE 29.—Comparison of loading equipment, "mother" conveyors, and shuttle cars in use in bituminous-coal and lignite mines in the United States in 1948 with sales in 1949, by States

State	Mechanical loading equipment						"Mother" conveyors [3]	Shuttle cars	
	Mobile loaders [1]		Scrapers		Conveyors [2]				
	In use 1948	Sales 1949	In use 1948	Sales 1949	In use 1948	Sales 1949	Sales [4] 1949	Sales [4] 1936–48	Sales [4] 1949
Alabama	143	22	29		416	16		181	35
Arkansas	1	1			74	7			
Colorado	32	7		2	326	6	3	41	10
Idaho						1			
Illinois	565	23		1	18	13	8	290	76
Indiana	163	14					4	125	22
Iowa	7				7				
Kansas						1			
Kentucky	422	36			726	38	16	518	61
Maryland	1				38				
Missouri						2			1
Montana	35				8	3		2	
Nebraska						1			
New Mexico	19		2		1	1		13	
North Carolina							1		
North Dakota	7	1				1		9	
Ohio	195	12			178	3	3	127	15
Oklahoma	4				61	1	3		
Pennsylvania	928	57	7		969	72	13	483	143
Tennessee	26	1			208	9		69	2
Utah	91	11	1		119	15	2	55	15
Virginia	115	8			197	8	3	70	5
Washington			9		92				
West Virginia	1,197	92		5	2,017	193	59	850	155
Wyoming	29	1	8		302	3	1	14	3
Total	3,980	286	56	8	5,757	394	116	2,847	543

[1] Includes continuous miners.
[2] Includes hand-loaded conveyors and conveyors equipped with duckbills or other self-loading heads.
[3] Includes all haulage conveyors with capacity over 500 feet except main slope conveyors.
[4] Data on number in use not available.

TABLE 30.—Bituminous coal and lignite mechanically loaded underground in the United States, by type of loading equipment, 1947–48

Type of equipment	1947 Net tons	1947 Percent of total	1948 Net tons	1948 Percent of total
Mobile loaders:				
Loading direct into mine cars	155,352,706	52.1	144,184,869	48.7
Loading onto conveyors	10,025,273	3.4	10,849,722	3.7
Loading into rubber-tired trucks	64,458,027	21.6	77,632,581	26.2
Scrapers	854,113	.3	743,251	.3
Pit-car loaders	352,573	.1	183,931	.1
Conveyors equipped with duckbills or other self-loading heads	21,921,484	7.3	19,633,503	6.6
Hand-loaded conveyors	45,193,105	15.2	42,578,428	14.4
Total loaded mechanically	298,157,281	100.0	295,806,285	100.0

TABLE 31.—Mechanical loading underground in bituminous-coal and lignite mines in the United States, by States, in 1948

State	Number of mines				Number of loading devices					Production mechanically loaded (net tons)			Total underground production at mines using mechanical loading devices (net tons)			
	Using loading machines only [1]	Using conveyors only [2]	Using both loading machines and conveyors	Total	Mobile loading machines [3]	Scrapers	Conveyors equipped with duckbills or other self-loading heads	Pit-car loaders	Hand-loaded conveyors (number of units)	Loaded by machines [1]	Handled by conveyors [2]	Total	Mines using loading machines only [1]	Mines using conveyors only [2]	Mines using both loading machines and conveyors	Total
Alabama	21	16	15	52	143	29	43		373	7,929,533	2,967,426	10,896,959	5,569,494	2,740,153	4,937,347	13,246,994
Arkansas		14	2	16	1		3		71	80,000	817,126	897,126		766,058	137,518	903,576
Colorado	38	17	6	61	32		218	2	108	3,007,560	407,873	3,415,433	3,354,872	350,899	414,798	4,120,569
Illinois	80	1	2	83	565		18	35		42,874,637	167,779	43,042,416	41,813,951	97,231	1,358,001	43,269,183
Indiana	20			20	163					8,847,739		8,847,739	9,008,206			9,008,206
Iowa	2	1	1	4	7		5		2	186,041	9,236	195,277	180,135	7,500	7,642	195,277
Kentucky	133	37	32	202	422		220		506	26,837,622	4,732,021	31,569,643	27,530,469	4,531,602	8,983,789	41,045,860
Maryland	1	3	1	5	1		5		33	114,940	172,451	287,391	65,405	252,610	166,810	484,825
Montana (bituminous and lignite)	6	1		7	35		6		2	891,422	10,000	901,422	892,960	28,296		921,256
New Mexico	4			4	19	2	1			1,129,037		1,129,037	1,129,037			1,129,037
North Dakota (lignite)	2			2	7					460,781		460,781	460,781			460,781
Ohio	40	7	4	51	195		154		24	13,201,070	188,357	13,389,427	13,747,180	169,025	452,286	14,368,491
Oklahoma		6	1	7	4				61	114,176	394,138	508,314		374,138	134,176	508,314
Pennsylvania	114	98	38	250	928	7	107		862	46,321,056	7,177,441	53,498,497	50,771,041	7,242,823	12,283,138	70,297,002
Tennessee	13	10	12	35	26		52		156	1,582,994	1,446,674	3,029,668	1,681,044	1,266,393	1,604,367	4,551,804
Utah	25	6	1	32	91	1	105		14	6,515,901	72,993	6,588,894	6,576,289	72,890	17,054	6,666,233
Virginia	28	12	9	49	115		61		136	5,921,080	1,622,476	7,543,556	7,093,344	1,702,311	3,329,391	12,125,046
Washington	3	3	4	10		9	6		86	139,189	502,262	641,451	81,662	62,230	527,932	671,824
West Virginia	220	116	106	442	1,197		363		1,654	81,933,863	21,821,419	103,755,282	75,489,691	19,416,806	31,392,223	126,298,720
Wyoming	19	1	3	23	29	8	265		37	4,955,285	252,687	5,207,972	4,902,445	103,368	272,148	5,277,961
Total: 1948	769	349	237	1,355	3,980	56	1,632	37	4,125	253,043,926	42,762,359	295,806,285	250,348,006	39,184,333	66,018,620	355,550,959
1947	707	335	221	1,263	3,569	67	1,531	71	3,979	252,611,603	45,545,678	298,157,281	258,202,279	43,480,833	69,736,625	371,419,737
Percent change 1948 from 1947	+8.8	+4.2	+7.2	+7.3	+11.5	−16.4	+6.6	−47.9	+3.7	+0.2	−6.1	−0.8	−3.0	−9.9	−5.3	−4.3

[1] Includes mobile loaders, scrapers, and conveyors equipped with duckbills or other self-loading heads; some mines in this class use conveyors or shuttle cars in conjunction with mobile loaders to perform initial phase of transportation.
[2] Includes hand-loaded conveyors and pit-car loaders.
[3] Includes continuous miners.

TABLE 32.—Comparative changes in underground mechanical loading of bituminous coal and lignite by principal types of loading devices in the United States, by States, 1947–48

State	Net tons						Handled by each class (percent)				Underground output mechanically loaded (percent)	
	1947			1948			1947		1948			
	Loaded by machines [1]	Handled by conveyors [2]	Tota	Loaded by machines [1]	Handled by conveyors [2]	Total	Loaded by machines [1]	Handled by conveyors [2]	Loaded by machines [1]	Handled by conveyors [2]	1947	1948
Alabama	7,282,480	3,306,910	10,589,390	7,929,533	2,967,426	10,896,959	68.8	31.2	72.8	27.2	61.9	64.6
Arkansas	----------	895,347	895,347	80,000	817,126	897,126	----------	100.0	8.9	91.1	80.0	79.9
Colorado	3,274,355	402,370	3,676,725	3,007,560	407,873	3,415,433	89.1	10.9	88.1	11.9	60.2	64.3
Illinois	44,059,377	343,466	44,402,843	42,874,637	167,779	43,042,416	99.2	.8	99.6	.4	88.6	90.1
Indiana	10,246,786	----------	10,246,786	8,847,739	----------	8,847,739	100.0	----------	100.0	----------	91.9	88.9
Iowa	222,843	3,522	226,365	186,041	9,236	195,277	98.4	1.6	95.3	4.7	24.0	22.1
Kentucky	25,168,853	5,156,903	30,325,756	26,837,622	4,732,021	31,569,643	83.0	17.0	85.0	15.0	41.2	45.3
Maryland	192,666	255,611	448,277	114,940	172,451	287,391	43.0	57.0	40.0	60.0	30.9	23.6
Michigan	----------	2,803	2,803	----------	----------	----------	----------	100.0	----------	----------	20.0	----------
Montana (bituminous and lignite)	1,046,095	10,000	1,056,095	891,422	10,000	901,422	99.1	.9	98.9	1.1	91.1	91.4
New Mexico	1,067,882	----------	1,067,882	1,129,037	----------	1,129,037	100.0	----------	100.0	----------	74.0	82.8
North Dakota (lignite)	423,887	----------	423,887	460,781	----------	460,781	100.0	----------	100.0	----------	89.8	95.0
Ohio	14,265,963	203,910	14,469,873	13,201,070	188,357	13,389,427	98.6	1.4	98.6	1.4	71.7	72.7
Oklahoma	130,000	602,686	732,686	114,176	394,138	508,314	17.7	82.3	22.5	77.5	65.7	45.0
Pennsylvania	47,453,321	7,934,034	55,387,355	46,321,056	7,177,441	53,498,497	85.7	14.3	86.6	13.4	50.4	54.2
Tennessee	1,210,494	1,638,992	2,849,486	1,582,994	1,446,674	3,029,668	42.5	57.5	52.2	47.8	49.6	54.0
Utah	6,966,048	93,137	7,059,185	6,515,901	72,993	6,588,894	98.7	1.3	98.9	1.1	95.0	96.7
Virginia	5,599,650	1,746,345	7,345,995	5,921,080	1,622,476	7,543,556	76.2	23.8	78.5	21.5	38.6	45.5
Washington	101,777	421,303	523,080	139,189	502,262	641,451	19.5	80.5	21.7	78.3	56.8	66.9
West Virginia	77,530,206	22,219,071	99,749,277	81,933,863	21,821,419	103,755,282	77.7	22.3	79.0	21.0	64.7	69.2
Wyoming	6,368,920	309,268	6,678,188	4,955,285	252,687	5,207,972	95.4	4.6	95.1	4.9	98.5	97.3
Total	252,611,603	45,545,678	298,157,281	253,043,926	42,762,359	295,806,285	84.7	15.3	85.5	14.5	60.7	64.3

[1] Includes mobile loaders, scrapers, and conveyors equipped with duckbills or other self-loading heads.
[2] Includes hand-loaded conveyors and pit-car loaders.

TABLE 33.—Bituminous-coal and lignite production, by methods of mining and loading and average output per man per day, in the United States, by States, in 1948

State	Mined by stripping		Mined underground				Total	
	Net tons	Average tons per man per day	Hand-loaded (net tons)	Mechanically loaded (net tons)	Total (net tons)	Average tons per man per day	Net tons	Average tons per man per day
Alabama	1,937,207	9.78	5,966,788	10,896,959	16,863,747	3.52	18,800,954	3.77
Alaska	140,477	11.71	267,429		267,429	4.65	407,906	5.87
Arizona			4,599		4,599	2.33	4,599	2.33
Arkansas	538,914	8.81	226,147	897,126	1,123,273	2.89	1,662,187	3.69
California (lignite)	1,450	4.42					1,450	4.42
Colorado	315,835	14.72	1,899,518	3,415,433	5,314,951	5.04	5,630,786	5.23
Georgia			20,000		20,000	2.24	20,000	2.24
Illinois	17,583,845	18.52	4,715,828	43,042,416	47,758,244	7.50	65,342,089	8.94
Indiana	13,893,890	16.34	1,107,628	8,847,739	9,955,367	7.17	23,849,257	10.65
Iowa	788,126	9.93	686,753	195,277	882,030	3.57	1,670,156	5.12
Kansas	2,376,042	13.48	161,998		161,998	2.62	2,538,040	10.66
Kentucky	12,384,475	18.57	38,129,821	31,569,643	69,699,464	5.46	82,083,939	6.11
Maryland	443,085	10.57	930,688	287,391	1,218,079	3.88	1,661,164	4.67
Michigan			13,020		13,020	2.34	13,020	2.34
Missouri	3,671,351	15.60	351,137		351,137	2.49	4,022,488	10.69
Montana (bituminous)	1,909,653	84.12	57,327	892,950	950,277	6.52	2,859,930	16.98
Montana (lignite)	1,579	9.18	27,609	8,472	36,081	5.89	37,660	5.98
New Mexico			234,895	1,129,037	1,363,932	4.95	1,363,932	4.95
North Dakota (lignite)	2,476,158	22.08	24,050	460,781	484,831	9.84	2,960,989	18.35
Ohio	20,295,206	15.86	5,023,645	13,389,427	18,413,072	5.72	38,708,278	8.61
Oklahoma	2,331,405	12.14	622,465	508,314	1,130,779	3.84	3,462,184	7.12
Pennsylvania	35,771,314	13.29	45,272,446	53,498,497	98,770,943	4.78	134,542,257	5.76
South Dakota (lignite)	29,094	7.62					29,094	7.62
Tennessee	873,718	10.49	2,579,643	3,029,668	5,609,311	4.45	6,483,029	4.82
Texas (lignite)	56,693	13.37					56,693	13.37
Utah			224,456	6,588,894	6,813,350	6.72	6,813,350	6.72
Virginia	1,416,187	13.45	9,039,662	7,543,556	16,583,218	4.40	17,999,405	4.64
Washington	260,602	9.24	317,850	641,451	959,301	3.60	1,219,903	4.13
West Virginia	18,950,541	15.11	46,155,923	103,755,282	149,911,205	5.50	168,861,746	5.92
Wyoming	1,059,073	17.69	144,699	5,207,972	5,352,671	7.05	6,411,744	7.83
Total 1948	139,505,920	15.28	164,206,024	295,806,285	460,012,309	5.31	599,518,229	6.26

MECHANICAL CLEANING

Bituminous coal mechanically cleaned in 1948 amounted to 180,880,323 tons, or 30 percent of the total output.

Mechanical cleaning by wet methods includes jigs, concentrating tables, classifiers, launders, dense-medium processes, and any combinations of these five methods.

Pneumatic methods of coal cleaning include air tables, air flow, air sand, and any combination of these three methods.

Tables 34, 35, 38, and 39 include mechanical-cleaning data on all coal mined in the United States except Pennsylvania anthracite. Tables 36 and 37 are on the same basis but do not include consumer-operated plants. There are no mechanical cleaning plants at lignite mines.

Consumer-operated plants include plants owned by steel companies that receive coal (usually from affiliated companies), clean it, and then consume it directly at the plant.

Types of Cleaning Equipment.—The tonnage of bituminous coal cleaned by wet-washing methods was 164,664,522 tons in 1948—an increase of 6 percent over 1947. The quantity cleaned by pneumatic methods was 16,215,801 tons—a decrease of 12 percent.

Table 35 compares the number of cleaning plants and the tons of cleaned coal, by types of equipment, for 1947 and 1948. During 1948, 482 wet-washing and 84 pneumatic cleaning plants were in operation. Sixty-four tipples used both wet and dry methods at the same plant; deducting these duplications gives a net total of 502 plants that cleaned coal in 1948, an increase of 41 plants over 1947.

Mines served by cleaning plants (exclusive of those that ship to washeries operated by steel companies) produced 251,711,541 tons, or 42 percent of the total bituminous output in 1948. In this same group of mines, 170,478,391 tons were cleaned mechanically; therefore, 68 percent of the coal produced at mines with cleaning plants in 1948 was cleaned at the mine. The remainder of the output from these mines (32 percent) presumably represents the larger sizes commonly picked by hand. (See tables 37 and 39.)

Relation Between Raw Coal, Clean Coal, and Refuse.—For every 100 tons of raw coal cleaned during 1948 at the mines, 84 tons of clean merchantable coal, on an average, were obtained, and 16 tons of refuse were discarded. Table 39 shows total production of mines with cleaning plants and results of cleaning operations, by States.

Methods of Mining at Mines Served by Cleaning Plants.—Underground mechanical loading appears to be closely related to mechanical cleaning. Underground coal loaded mechanically in 1948 totaled 295,806,285 tons, of which 171,345,813 tons (58 percent) passed through tipples equipped with mechanical cleaning devices. Production of coal from strip mines in 1948 was 139,505,920 tons, of which 44,304,574 tons (32 percent) came from strip mines having mechanical cleaning tipples. Hand-loaded underground coal production in 1948 totaled 164,206,024 tons, of which 22 percent passed through tipples equipped with cleaning plants. (See tables 33 and 37.)

Historical Data on Mechanical Cleaning.—Table 16 shows data on bituminous coal cleaned by types of equipment, 1927-48, inclusive.

Data on method of mining at bituminous-coal mines served by cleaning plants, for the years 1933–48, are given in table 17.

TABLE 34.—Bituminous coal mechanically cleaned by wet and pneumatic methods, in the United States, in net tons of clean coal, 1945–48

Method of cleaning	1945	1946	1947	1948	Change 1948 from 1947 (percent)
Wet methods:					
At mines	121,418,585	115,120,292	145,958,413	154,262,590	+5.7
At consumer-operated cleaning plants	9,051,154	6,938,347	10,125,039	10,401,932	+2.7
Total wet methods	130,469,739	122,058,639	156,083,452	164,664,522	+5.5
Pneumatic methods	17,416,197	16,611,198	18,352,485	16,215,801	−11.6
Grand total	147,885,936	138,669,837	174,435,937	180,880,323	+3.7

TABLE 35.—Bituminous coal cleaned in the United States, by type of equipment in actual operation, 1947–48

[Coal cleaned and plants operated by consumers at central washeries in Colorado and Pennsylvania included]

Type of equipment	Plants in operation		Net tons of clean coal		Cleaned by each type (percent of total)	
	1947	1948	1947	1948	1947	1948
Wet methods:						
Jigs	234	249	85,931,353	87,506,353	49.3	48.4
Concentrating tables	9	11	2,980,368	4,359,859	1.7	2.4
Classifiers	67	74	14,647,771	18,304,622	8.4	10.1
Launders	19	18	17,902,394	16,787,899	10.3	9.3
Dense-media	70	86	17,702,322	20,637,635	10.1	11.4
Jigs and concentrating tables	14	15	4,302,422	5,252,035	2.5	2.9
Other combinations of above methods	27	29	12,616,822	11,816,119	7.2	6.5
Total wet methods	440	482	156,083,452	164,664,522	89.5	91.0
Pneumatic methods	84	84	18,352,485	16,215,801	10.5	9.0
Grand total	[1] 524	[1] 566	174,435,937	180,880,323	100.0	100.0

[1] Number of plants using both wet and pneumatic methods was 63 in 1947 and 64 in 1948.

TABLE 36.—Total production of all coal at bituminous mines in the United States having cleaning plants, 1947–48, in net tons

[Does not include estimates for mines that may ship to consumer-operated plants]

Type of equipment	1947	1948	Change 1948 from 1947 (percent)
Wet methods:			
Jigs	123,267,688	127,475,329	+3.4
Concentrating tables	945,919	1,659,611	+75.4
Classifiers	33,176,301	35,275,913	+6.3
Launders	19,721,354	16,000,190	−18.9
Dense-media	34,901,017	40,965,796	+17.4
Jigs and concentrating tables	4,697,185	5,552,845	+18.2
Other combinations of above methods	17,953,150	16,929,753	−5.7
Total wet methods	234,662,614	243,859,437	+3.9
Pneumatic methods	59,917,199	56,288,590	−6.1
Grand total	294,579,813	300,148,027	+1.9
Less duplications [1]	50,068,272	48,436,486	−3.3
Net total	244,511,541	251,711,541	+2.9
United States total production [2]	630,623,722	599,518,229	−4.9
Percent produced at mines having cleaning plants	38.8	42.0	

[1] Mines using both wet and pneumatic methods.
[2] Includes all coal except Pennsylvania anthracite. There are no mechanical cleaning plants at lignite mines.

TABLE 37.—Total production from bituminous-coal mines served by cleaning plants, by method of mining, 1945–48

[Does not include estimates for mines that may ship to consumer-operated plants]

Method of mining	1945		1946		1947		1948	
	Thousand tons	Percent	Thousand tons	Percent	Thousand tons	Percent	Thousand tons	Percent
Mined from strip pits	35,910	16.8	33,222	16.6	42,016	17.2	44,305	17.6
Mechanically loaded underground	129,733	60.5	125,521	62.7	158,507	64.8	171,346	68.1
Hand-loaded underground	48,615	22.7	41,531	20.7	43,988	18.0	36,061	14.3
Total	214,258	100.0	200,274	100.0	244,511	100.0	251,712	100.0

TABLE 38.—Bituminous coal mechanically cleaned by wet and pneumatic methods in the United States, by States, 1947–48

[Coal cleaned and plants operated by consumers at central washeries in Colorado and Pennsylvania included]

State	Plants in operation		Net tons of clean coal		Output mechanically cleaned (percent)	
	1947	1948	1947	1948	1947	1948
Alabama	52	55	13,923,152	13,463,049	73.1	71.6
Alaska	1	1	171,799	147,360	47.6	36.1
Arkansas	4	4	250,060	134,569	13.4	8.1
Colorado	8	8	1,373,708	1,530,318	21.6	27.2
Illinois	53	55	33,363,568	34,619,845	49.2	53.0
Indiana	22	22	13,865,723	13,530,612	54.5	56.7
Kansas	4	3	1,349,393	1,191,344	49.2	46.9
Kentucky	30	37	12,195,014	11,560,556	14.5	14.1
Maryland	2	2	318,498	216,637	15.5	13.0
Missouri	9	9	3,071,263	3,310,227	72.5	82.3
Montana	3	3	170,522	182,721	5.4	6.3
New Mexico	3	2	477,873	411,325	33.1	30.2
Ohio	15	19	9,366,478	10,340,972	24.9	26.7
Oklahoma	2	2	385,442	706,311	11.3	20.4
Pennsylvania [1]	62	66	36,728,026	35,602,133	25.0	26.5
Tennessee	3	3	188,572	266,900	3.0	4.1
Utah	3	5	1,679,577	2,134,386	22.6	31.3
Virginia	18	21	3,375,524	4,098,567	16.7	22.8
Washington	19	20	954,734	1,055,749	85.4	86.5
West Virginia [2]	148	165	41,227,011	46,376,742	23.4	27.5
Total	[3] 461	[4] 502	174,435,937	180,880,323	27.7	30.2

[1] Includes some coal mined in Pennsylvania and cleaned in Ohio and a small tonnage mined in other States and cleaned at a consumer-operated plant in Pennsylvania.
[2] Includes some coal mined in West Virginia and cleaned in Ohio and Pennsylvania.
[3] Represents 63 plants using both wet and pneumatic methods of cleaning and 398 plants using only 1 cleaning method.
[4] Represents 64 plants using both wet and pneumatic methods of cleaning and 438 plants using only 1 cleaning method.

TABLE 39.—Result of operations at bituminous-coal-cleaning plants in the United States, by States, in net tons, in 1948

State	Total raw coal moved to cleaning plants	Coal obtained in cleaning process	Refuse resulting in cleaning process	Ratio of refuse to raw coal (percent) [1]	Total production from mines served by cleaning plants
Alabama	18,178,213	13,463,049	4,715,164	25.9	14,350,310
Alaska	211,360	147,360	64,000	30.3	147,360
Arkansas	156,803	134,569	22,234	14.2	368,354
Colorado	124,823	112,717	12,106	9.7	754,318
Illinois	41,030,525	34,619,845	6,410,680	15.6	49,125,543
Indiana	16,195,158	13,530,612	2,664,546	16.5	16,894,527
Kansas	1,508,778	1,191,344	317,434	21.0	1,208,630
Kentucky	13,961,532	11,560,556	2,400,976	17.2	16,335,040
Maryland	262,141	216,637	45,504	17.4	375,423
Missouri	4,085,008	3,310,227	774,781	19.0	3,375,363
Montana	194,621	182,721	11,900	6.1	235,326
New Mexico	541,367	411,325	130,042	24.0	771,512
Ohio	13,081,409	10,340,972	2,740,437	20.9	13,520,153
Oklahoma	858,785	706,311	152,474	17.8	707,041
Pennsylvania [2]	32,047,676	26,617,802	5,429,874	16.9	37,346,027
Tennessee	285,600	266,900	18,700	6.5	748,000
Utah	2,264,923	2,134,386	130,537	5.8	2,774,780
Virginia	4,597,293	4,098,567	498,726	10.8	8,991,323
Washington	1,307,423	1,055,749	251,674	19.2	1,113,343
West Virginia [3]	52,799,266	46,376,742	6,422,524	12.2	82,569,168
Total at mines only [4]	203,692,704	170,478,391	33,214,313	16.3	251,711,541
Consumer plants [5]	11,524,467	10,401,932	1,122,535	9.7	----------
Grand total 1948	215,217,171	180,880,323	34,336,848	16.0	----------

[1] In Alabama (for example) for every 100 tons of raw coal cleaned in 1948, an average of 25.9 tons of refuse was discarded and 74.1 tons of clean marketable coal was obtained.
[2] Includes some coal that was mined in Pennsylvania and cleaned in Ohio.
[3] Includes some coal that was mined in West Virginia and cleaned in Ohio and Pennsylvania.
[4] Includes all mechanical cleaning other than washeries operated by consumer steel companies.
[5] Includes central washeries in Colorado and Pennsylvania operated by consumer steel companies.

DETAILED STATISTICS, BY STATES AND COUNTIES

Detailed production and employment statistics are given in table 40 for each coal-producing county in the United States from which three or more operators submitted reports for 1948. Statistics on counties with less than three reporting producers have been combined with data for other counties in the same State to avoid disclosing individual figures, unless the operators have granted permission to publish them separately. Production of mines on the border between two States has been credited to the State from which the coal was extracted rather than to that in which the tipple was situated. If the coal is mined from lands in both States, the tonnage has been apportioned accordingly.

The data in the present report, as in those published for many years by the Bureau of Mines, relate only to mines with an annual output of 1,000 tons or more. That fact should be borne in mind when the statistics in this report are compared with similar data compiled by State mine departments. Differences arise largely from variations in coverage by State reports, some of which include data for all mines regardless of size, and others only data for mines employing more than a specified minimum number, ranging from 2 to 10 men.

Because of a change in method of reporting, beginning with 1946, statistics of average production per man per day are not precisely comparable with those for other years. The figures since 1946 were based on the average number of men working daily, whereas the figures for previous years were based on the average number of men on the rolls per pay period.

TABLE 40.—Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1948

[Exclusive of mines producing less than 1,000 tons]

County	Production (net tons)				Average value per ton [3]	Average number of men working daily				Average number of days mines were active	Number of man-days worked	Average tons per man per day [4]
	Shipped by rail or water [1]	Shipped by truck	Used at mine [2]	Total		Underground	Surface: In strip pits	Surface: All others	Total			
ALABAMA												
Bibb	658,883	46,999	18,803	724,685	$7.14	948	2	301	1,251	213	266,818	2.72
Blount	98,687	223,218	1,355	323,260	6.15	314	36	47	397	255	101,285	3.19
Cullman	1,381	43,063	86	44,530	6.11	82		9	91	219	19,914	2.24
Jackson	2,723	15,099	208	18,030	5.62	26		7	33	248	8,191	2.20
Jefferson	9,283,513	331,768	65,528	9,680,809	6.17	10,083	135	1,930	12,148	230	2,790,789	3.47
Marion	160,284	209,966	2,463	372,713	7.69	610		93	703	211	148,596	2.51
St. Clair	702,368	71,711	6,674	780,753	6.08	668	48	126	842	220	185,551	4.21
Shelby	358,076	82,334	2,392	442,802	6.99	641		93	734	216	158,318	2.80
Tuscaloosa	659,193	109,879	1,528	770,600	5.53	419	106	145	670	228	152,576	5.05
Walker	4,169,346	886,130	562,059	5,617,535	5.90	4,423	362	838	5,623	204	1,146,871	4.90
Winston	2,550	22,687		25,237	5.99	31			31	257	7,967	3.17
Total Alabama	16,097,004	2,042,854	661,096	18,800,954	6.15	18,245	689	3,589	22,523	221	4,986,876	3.77
ALASKA												
Total Alaska	294,832	108,917	4,157	407,906	$6.84	142	34	60	236	294	69,463	5.87
ARIZONA												
Total Arizona		4,599		4,599	$5.26	8			8	247	1,972	2.33

ARKANSAS

Franklin	139,806	182	936	140,924	$7.89	256	28	46	330	178	58,618	2.40
Johnson	396,891	8,925	1,005	406,821	7.21	249	67	114	430	185	79,421	5.12
Logan	257,872		2,046	259,918	9.35	512		79	591	171	101,057	2.57
Pope	57,341		272	57,613	8.14	86		21	107	215	23,005	2.50
Scott	84,825			84,825	6.33	14	26	12	52	140	7,290	11.64
Sebastian	699,307	11,774	1,005	712,086	7.58	727	125	140	992	182	180,900	3.94
Total Arkansas	1,636,042	20,881	5,264	1,662,187	7.75	1,844	246	412	2,502	180	450,291	3.69

CALIFORNIA (LIGNITE)

Total California		1,450		1,450	$10.00		4		4	82	328	4.42

COLORADO

Boulder	76,835	154,007	4,232	235,074	$5.18	187		36	223	217	48,295	4.87
Delta	65,882	27,769	3,903	97,554	4.48	80	3	24	107	193	20,621	4.73
Elbert		1,130	41	1,171	3.65	2		1	3	192	576	2.03
El Paso	41,749	114,927	36,112	192,788	3.97	141	5	35	181	250	45,332	4.25
Fremont	106,556	286,640	1,677	394,873	5.19	294	7	77	378	198	74,741	5.28
Garfield	11,806	35,100		46,906	4.79	46		6	52	219	11,392	4.12
Gunnison	522,596	35,909	29,501	588,006	4.92	423		132	555	188	104,567	5.62
Huerfano	495,461	53,080	2,838	551,370	5.18	474	17	121	612	180	113,645	4.85
Jackson	28,324	3,697		32,021	4.72		15	2	17	190	3,232	9.91
Jefferson	89,190	17,289	120	106,599	4.75	106		28	134	202	27,085	3.94
La Plata	13,906	35,007	10	48,923	3.47	47		10	57	203	11,569	4.23
Las Animas	1,046,679	75,427	19,898	1,142,004	5.29	1,261		209	1,470	201	295,657	3.86
Mesa	75,198	22,071	382	97,651	4.25	85		11	96	199	19,127	5.11
Moffat	122,579	21,604	105	144,288	5.18	61		17	78	210	16,397	8.80
Montrose		1,464	12,285	13,749	4.07	11			11	211	2,325	5.01
Rio Blanco	4,393	16,915	85	21,393	4.62	16		3	19	215	4,093	5.23
Routt	860,483	40,855	38,537	939,875	5.12	585	20	295	900	159	143,192	6.56
Weld	563,987	390,600	21,945	976,532	4.49	612		121	733	183	134,320	7.27
Total Colorado	4,125,624	1,333,491	171,671	5,630,786	4.94	4,431	67	1,128	5,626	191	1,076,166	5.23

GEORGIA

Total Georgia	20,000			20,000	$6.19	39		6	45	198	8,910	2.24

See footnotes at end of table.

TABLE 40.—Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1948—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Production (net tons)				Average value per ton [3]	Average number of men working daily				Average number of days mines were active	Number of man-days worked	Average tons per man per day [4]
	Shipped by rail or water [1]	Shipped by truck	Used at mine [2]	Total		Underground	Surface		Total			
							In strip pits	All others				
ILLINOIS												
Bureau	565,091	120,151	392	685,634	$4.24		60	109	169	268	45,276	15.14
Christian	7,828,514	101,536	50,279	7,980,329	2.98	2,382		682	3,064	260	797,232	10.01
Clinton	177,591	109,025	9,531	296,147	4.04	224		58	282	224	63,112	4.69
Douglas	114,311			114,311	4.10	60		10	70	249	17,430	6.56
Edgar		26,655	1,499	28,154	3.61	45		6	51	111	5,661	4.97
Franklin	11,996,839	362,879	441,042	12,800,760	4.29	5,474		1,983	7,457	239	1,781,552	7.19
Fulton	5,413,704	308,983	21,724	5,744,411	3.76	209	451	556	1,216	234	284,316	20.20
Gallatin	45,178	24,051	1,516	70,745	3.95	76		19	95	172	16,340	4.33
Hancock		46,677	400	47,077	5.14		20	7	27	201	5,435	8.66
Henry	57,045	52,435	1,238	110,718	4.67	59		16	75	235	17,632	6.28
Jackson	1,068,378	162,296	9,660	1,240,334	4.06	323	71	159	553	230	127,087	9.76
Jefferson	512,559	29,456	28,630	570,645	4.32	286		81	367	215	79,037	7.22
Knox	2,031,052	107,296	8,370	2,146,718	3.23	89	276	200	565	249	140,668	15.26
La Salle	19,261	110,766	9,820	139,847	5.79	119	18	34	171	173	29,575	4.73
Livingston		5,255		5,255	5.89		5		5	110	550	9.55
Logan		49,528		49,528	5.05	35		8	43	208	8,944	5.54
Macoupin	3,972,996	145,919	162,378	4,281,293	3.67	2,123		496	2,619	236	618,301	6.92
Madison	1,052,919	895,418	72,233	2,020,570	4.25	1,042		286	1,328	234	311,278	6.49
Marion	177,359	25,862	7,401	210,622	4.06	118		41	159	243	38,637	5.45
Menard		22,905	535	23,440	5.05	42		8	50	242	12,084	1.94
Montgomery	764,212	27,700	58,251	850,163	3.67	241		78	319	279	89,001	9.55
Peoria	390,416	247,138	3,751	641,305	3.50	373		58	431	228	98,374	6.52
Perry	5,074,742	96,933	45,071	5,216,746	3.92	1,008	251	716	1,975	232	458,363	11.38
Randolph	2,290,490	99,428	25,561	2,415,479	3.84	652	50	314	1,016	198	201,627	11.98
St. Clair	1,305,355	1,664,815	51,312	3,021,482	3.97	1,261	101	347	1,709	196	334,422	9.03
Saline	4,399,921	83,288	77,012	4,560,221	3.89	1,900	134	654	2,688	225	605,042	7.54
Sangamon	1,471,118	722,782	38,752	2,232,652	3.74	1,176		260	1,436	230	330,125	6.76
Schuyler	108,837	29,366	1,325	139,528	4.22	23	17	27	67	171	11,426	12.21
Tazewell		69,553	3,385	72,938	6.22	71		10	81	206	16,651	4.38
Vermilion	145,374	213,209	158	358,741	4.51	174	31	30	235	216	50,747	7.07
Warren		2,272	20	2,292	5.00	3		1	4	274	1,096	2.09
Washington	422,112	54,971	18,057	495,140	3.98	283		69	352	231	81,192	6.10
Williamson	4,375,057	495,189	49,938	4,920,184	4.09	2,046	222	610	2,878	175	502,425	9.79
Woodford		13,658		13,658	6.73	17		3	20	223	4,460	3.06
Other counties: Grundy and Will	1,420,649	404,894	9,479	1,835,022	4.79		255	229	484	264	127,774	14.36
Total Illinois	57,201,080	6,932,289	1,208,720	65,342,089	3.88	21,934	1,962	8,165	32,061	228	7,312,872	8.94

INDIANA

Clay	1,768,335	129,023	5,315	1,902,673	$4.37	22	434	155	611	220	134,336	14.16
Daviess	506,067	1,867	----	507,934	4.27	16	48	52	116	246	28,557	17.79
Dubois	----	31,997	----	31,997	3.76	15	----	5	20	235	4,692	6.82
Gibson	580,974	173,952	19,880	774,806	4.55	476	12	84	572	174	99,771	7.77
Greene	865,332	60,981	4,089	930,402	4.22	204	109	116	429	128	55,126	16.88
Knox	2,617,768	548,049	39,871	3,205,688	3.64	1,288	87	474	1,849	226	417,420	7.68
Owen	----	15,401	----	15,401	4.05	----	6	----	6	275	1,650	9.33
Perry	----	1,220	----	1,220	3.50	3	----	----	3	150	450	2.71
Pike	3,591,414	53,565	20,407	3,665,386	3.93	2	566	373	941	228	214,749	17.07
Spencer	159,802	45,428	----	204,730	4.10	28	87	26	141	159	22,357	9.16
Sullivan	3,339,230	50,449	9,671	3,399,350	4.15	903	233	324	1,460	233	339,727	10.01
Vermillion	483,935	65,717	8,537	558,189	4.11	56	87	60	203	222	45,118	12.37
Vigo	3,885,833	292,973	411,409	4,590,215	4.11	2,227	128	452	2,807	210	588,074	7.81
Warrick	3,613,396	268,730	10,049	3,892,175	3.88	313	430	415	1,158	228	263,605	14.77
Other counties: Fountain and Parke	741	166,894	1,456	169,091	5.15	46	50	14	110	218	23,937	7.06
Total Indiana	21,412,327	1,906,246	530,684	23,849,257	4.04	5,599	2,277	2,550	10,426	215	2,230,569	10.65

IOWA

Adams	----	1,094	----	1,094	$4.82	6	----	2	8	28	224	4.88
Appanoose	49,475	120,526	1,715	171,716	5.11	361	----	37	398	184	73,105	2.35
Boone	38,194	19,498	2,381	60,073	5.49	51	----	8	59	228	13,470	4.46
Dallas	119,775	20,085	205	140,065	4.82	113	----	22	135	206	27,810	5.04
Davis	700	31,583	----	32,283	4.06	34	----	2	36	169	6,072	5.32
Greene	736	11,219	420	12,375	4.70	16	----	3	19	164	3,124	3.96
Guthrie	----	4,304	16	4,320	6.41	26	----	5	31	70	2,183	1.98
Jasper	----	50,174	215	50,389	4.36	47	4	9	60	234	14,045	3.59
Lucas	15,380	18,412	----	33,792	5.33	63	----	8	71	114	8,090	4.18
Mahaska	95,818	153,461	676	249,950	3.91	15	98	32	145	237	34,353	7.28
Marion	311,810	296,082	395	608,287	3.61	185	154	60	399	193	77,062	7.89
Monroe	65,708	92,483	665	158,856	4.73	213	4	30	247	162	40,010	3.97
Page	----	7,492	----	7,492	6.54	10	----	2	12	216	2,592	2.80
Van Buren	----	44,768	10	44,778	4.39	35	23	10	68	143	9,704	4.61
Wapello	14,095	70,409	----	84,504	3.56	19	25	13	57	108	11,281	7.49
Warren	----	10,182	----	10,182	4.41	17	----	3	20	160	3,200	3.18
Total Iowa	711,686	951,772	6,698	1,670,156	4.20	1,211	308	246	1,765	185	326,325	5.12

KANSAS

Bourbon	132,844	14,666	122	147,632	$4.00	----	39	21	60	208	12,506	11.80
Cherokee	856,726	39,065	2,931	898,722	3.85	58	176	108	342	188	64,288	13.98
Crawford	1,095,284	75,465	5,307	1,176,056	3.77	236	244	189	669	184	123,388	9.53
Franklin	----	1,024	----	1,024	3.71	----	4	----	4	40	160	6.40
Labette	----	3,664	----	3,664	4.81	----	6	----	6	167	1,002	3.66
Linn	271,430	7,643	----	279,073	3.45	17	60	18	95	210	20,825	13.40
Osage	----	31,869	----	31,869	5.94	84	15	11	110	145	15,924	2.00
Total Kansas	2,356,284	173,396	8,360	2,538,040	3.80	395	544	347	1,286	185	238,093	10.66

1 See footnotes at end of table.

TABLE 40.—Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1948—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Production (net tons)				Average value per ton [3]	Average number of men working daily				Average number of days mines were active	Number of man-days worked	Average tons per man per day [4]
	Shipped by rail or water [1]	Shipped by truck	Used at mine [2]	Total		Underground	Surface		Total			
							In strip pits	All others				
KENTUCKY												
Eastern Kentucky:												
Bell	2,472,110	507,844	25,619	3,005,573	$6.18	3,031	54	503	3,588	191	686,544	4.38
Boyd	172,091	258,582	-----	430,673	4.68	168	76	52	296	218	64,493	6.68
Breathitt	85,946	73,000	-----	158,946	5.47	224	-----	36	260	132	34,251	4.64
Carter	102,131	334,967	-----	437,098	5.41	275	-----	46	321	214	68,544	6.38
Clay	565,027	248,348	-----	813,375	5.76	975	65	214	1,254	200	250,588	3.25
Clinton	1,455	2,641	-----	4,096	4.48	9	-----	-----	9	120	1,080	3.79
Elliott	3,200	57,944	-----	61,144	4.49	62	5	10	77	176	13,571	4.51
Floyd	6,153,195	529,797	15,373	6,698,365	6.48	5,694	-----	1,053	6,747	192	1,202,753	5.18
Greenup	-----	87,812	-----	87,812	4.80	85	-----	14	99	176	17,387	5.05
Harlan	11,282,417	292,515	134,864	11,709,796	6.41	10,663	19	1,708	12,480	207	2,587,813	4.52
Jackson	2,900	119,785	-----	122,685	5.20	162	13	35	210	215	45,072	2.72
Johnson	565,005	387,476	3,689	956,170	6.32	1,054	-----	192	1,246	176	219,274	4.36
Knott	890,317	282,223	2,008	1,174,548	5.83	1,028	13	174	1,215	144	175,314	6.70
Knox	500,910	502,881	4,430	1,008,221	5.79	853	43	177	1,073	162	174,049	5.79
Laurel	104,046	137,219	472	241,737	5.31	201	41	51	293	167	48,868	4.95
Lawrence	-----	111,811	-----	111,811	4.87	95	18	21	134	210	28,192	3.97
Lee	50,470	46,307	-----	96,777	5.10	114	-----	20	134	229	30,700	3.15
Leslie	872,926	199,121	641	1,072,688	6.57	689	-----	114	803	188	151,227	7.09
Letcher	8,164,254	2,163,857	57,172	10,385,283	5.98	6,730	52	1,305	8,087	213	1,721,492	6.03
Magoffin	64,358	101,104	-----	165,462	5.17	215	10	74	299	142	42,524	3.89
Martin	410,738	18,712	196	429,646	5.36	282	-----	63	345	190	65,634	6.55
McCreary	633,813	167,019	17,166	817,998	5.83	876	40	119	1,035	180	186,332	4.39
Menifee	-----	36,283	-----	36,283	5.02	34	-----	6	40	257	10,280	3.53
Morgan	7,915	375,630	-----	383,545	5.41	202	28	45	275	243	66,735	5.75
Perry	6,428,439	165,453	91,097	6,684,989	5.92	5,186	40	939	6,165	197	1,214,769	5.50
Pike	11,102,845	641,807	210,448	11,955,100	5.44	9,657	99	1,748	11,504	193	2,222,995	5.38
Pulaski	24,118	67,620	-----	91,738	5.02	87	8	15	110	180	19,841	4.62
Rockcastle	48,504	20,000	-----	68,504	4.77	51	10	14	75	218	16,382	4.18
Wayne	30	4,426	2	4,458	4.13	10	-----	3	13	134	1,745	2.55
Whitley	374,033	80,268	2,726	457,027	5.87	463	49	99	611	182	111,392	4.10
Wolfe	-----	15,594	-----	15,594	5.51	19	-----	3	22	132	2,912	5.36
Total Eastern Kentucky	51,083,193	8,038,046	565,903	59,687,142	5.98	49,194	683	8,943	58,820	197	11,572,753	5.16

Western Kentucky:												
Butler		117,415		117,415	$4.19	70	14	15	99	192	18,999	6.18
Christian	10,550	880		11,430	4.44	11		2	13	173	2,249	5.08
Crittenden		3,973		3,973	3.89		6	3	9	50	450	8.83
Daviess	156,056	478,088	168	634,312	3.58	195	38	58	201	185	53,841	11.78
Edmonson		11,120		11,120	4.16	12			12	137	1,639	6.78
Grayson		9,211		9,211	4.43		21	8	29	60	1,740	5.29
Hancock	85,427	144,420		229,847	3.97	25	28	24	77	214	16,465	13.96
Henderson	56,700	196,475	162	253,337	3.38	207		37	244	215	52,372	4.84
Hopkins	11,614,455	1,069,701	8,319	12,692,475	3.95	2,630	745	1,344	4,719	194	913,174	13.90
McLean	23,158	102,699		125,857	4.20	99	8	20	127	144	18,278	6.89
Muhlenberg	4,926,899	285,179	64,281	5,276,359	3.84	2,071	392	585	3,048	167	507,507	10.40
Ohio	1,614,890	144,387	1,555	1,760,832	3.91	274	368	227	869	159	138,238	12.74
Union	588,278	35,155		623,433	3.82	246		62	308	252	77,690	8.02
Webster	593,261	53,935		647,196	3.99	265	84	73	422	130	58,681	11.03
Total Western Kentucky	19,669,674	2,652,638	74,485	22,396,797	3.90	6,105	1,704	2,458	10,267	181	1,861,323	12.03
Total Kentucky	70,752,867	10,690,684	640,388	82,083,939	5.41	55,299	2,387	11,401	69,087	194	13,434,076	6.11
MARYLAND												
Allegany	541,779	238,256	1,277	781,312	$5.26	684	131	138	953	180	171,333	4.56
Garrett	706,357	165,454	8,041	879,852	5.25	744	150	158	1,052	175	184,552	4.77
Total Maryland	1,248,136	403,710	9,318	1,661,164	5.26	1,428	281	296	2,005	177	355,885	4.67
MICHIGAN												
Total Michigan		12,178	842	13,020	$6.91	26		6	32	174	5,568	2.34
MISSOURI												
Adair		103,258	115	103,373	$4.35	143		21	164	191	31,280	3.30
Barton	306,325	42,850	1,710	350,885	4.01	8	61	41	110	216	23,774	14.76
Bates	710,073	9,675		719,748	3.45		60	69	129	242	31,270	23.02
Boone		52,405		52,405	3.70		14	2	16	273	4,362	12.01
Callaway		149,198	87	149,285	4.97		43	13	56	285	15,973	9.35
Clay		30,955	1,031	31,986	6.78	112		12	124	126	15,592	2.05
Dade		14,313		14,313	4.15		13		13	270	3,506	4.08
Daviess		7,511		7,511	6.01	30		5	35	183	6,405	1.17
Harrison		4,621	270	4,891	6.32	14		2	16	176	2,810	1.74
Henry	501,663	62,441	203	564,307	3.72		88	35	123	268	33,014	17.09
Jasper		2,974	513	3,487	4.45		6		6	205	1,230	2.83

See footnotes at end of table.

TABLE 40.—Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1948—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Production (net tons)				Average value per ton [3]	Average number of men working daily				Average number of days mines were active	Number of man-days worked	Average tons per man per day [4]
	Shipped by rail or water [1]	Shipped by truck	Used at mine [2]	Total		Underground	Surface		Total			
							In strip pits	All others				
MISSOURI—Continued												
Johnson	161,253	23,965	557	185,775	$4.10		37	16	53	238	12,621	14.72
Lafayette		40,880	659	41,539	6.00	99		13	112	186	20,844	1.99
Linn		13,642		13,642	6.20	45		8	53	197	10,441	1.31
Macon	797,589	39,244		836,833	3.67	26	84	102	212	263	55,772	15.00
Monroe		5,850		5,850	5.18		6	2	8	300	2,400	2.44
Putnam		23,601		23,601	4.92	56		8	64	152	9,700	2.43
Ralls		4,588		4,588	5.21	9	5	1	15	144	2,155	2.13
Randolph	491,957	64,141		556,098	4.06	124	34	91	249	225	56,107	9.91
Ray	5,000	6,200		11,200	6.67	68		12	80	83	6,664	1.68
St. Clair	35,110			35,110	3.41		20	11	31	186	5,780	6.07
Vernon	286,448	19,344	269	306,061	3.76		64	38	102	240	24,504	12.49
Total Missouri	3,295,418	721,656	5,414	4,022,488	3.90	734	535	502	1,771	212	376,204	10.69
MONTANA												
Bituminous coal:												
Blaine		6,741		6,741	$6.48	7			7	220	1,540	4.38
Carbon	221,522	14,425	599	236,546	4.49	95	10	44	149	201	29,980	7.89
Cascade		4,652		4,652	4.53	8		1	9	220	1,977	2.35
Fergus		2,084		2,084	5.00	2			2	290	580	3.59
Musselshell	686,771	25,660	4,426	716,857	3.90	385		187	572	198	113,252	6.33
Rosebud	1,890,398		2,652	1,893,050	1.25		61	19	80	264	21,084	89.79
Total bituminous coal	2,798,691	53,562	7,677	2,859,930	2.20	497	71	251	819	206	168,413	16.98
Lignite		37,571	89	37,660	3.30	26	2	8	36	175	6,295	5.98
Total Montana	2,798,691	91,133	7,766	2,897,590	2.22	523	73	259	855	204	174,708	16.59

NEW MEXICO

Bernalillo		1,365	14	1,379	$4.25	4		1	5	112	561	2.46
Colfax	1,128,152	5,245	10,646	1,144,043	4.95	692		182	874	241	210,430	5.44
McKinley	111,358	15,072	30,571	157,001	6.00	178		41	219	184	40,211	3.90
Rio Arriba	22,953	3,486	20	26,459	4.20	27		8	35	240	8,415	3.14
Santa Fe	16,047	16,047		32,094	6.52	38		10	48	279	13,391	2.40
Socorro		2,596	360	2,956	6.67	9		2	11	248	2,728	1.08
Total New Mexico	1,278,510	43,811	41,611	1,363,932	5.09	948		244	1,192	231	275,736	4.95

NORTH DAKOTA (LIGNITE)

Total North Dakota	2,406,919	472,586	81,484	2,960,989	$2.27	135	239	246	620	200	161,388	18.35

OHIO

Athens	1,336,314	151,333	5,416	1,493,063	$4.74	1,107	179	349	1,635	149	243,478	6.13
Belmont	8,373,288	307,416	26,947	8,707,651	4.29	4,446	329	931	5,706	210	1,199,704	7.26
Carroll	350,086	306,111	7,906	664,103	4.33	383	90	86	559	196	109,556	6.06
Columbiana	185,476	1,013,684	139	1,199,299	3.44	150	264	85	499	239	119,031	10.08
Coshocton	499,742	349,065	776	849,583	3.96	260	169	73	502	218	109,197	7.78
Gallia	224,448	169,212	205	393,865	4.48	383	24	78	485	216	104,991	3.75
Guernsey	336,842	66,447	75	403,364	4.09	133	81	44	258	232	59,814	6.74
Harrison	6,342,853	77,154	9,804	6,429,811	3.80	931	692	620	2,243	229	512,998	12.53
Hocking	291,916	102,119	259	394,294	4.79	393	35	66	494	166	81,840	4.82
Holmes		11,846		11,846	3.31	2	7		9	166	1,490	7.95
Jackson	145,428	108,562	17,475	271,465	3.97	165	73	31	269	195	52,331	5.19
Jefferson	4,817,198	1,246,883	27,261	6,091,342	4.04	1,756	577	735	3,068	214	657,452	9.27
Lawrence	25,424	116,760	7,532	149,716	4.12	122	15	20	157	212	33,310	4.49
Mahoning	7,214	458,454	41,423	507,091	4.23	7	93	22	122	274	33,385	15.19
Meigs	464,146	116,197	50	580,393	4.11	404	82	77	563	186	104,723	5.51
Morgan	263,709	38,032	919	302,660	4.58	240	15	53	308	180	55,541	5.45
Muskingum	1,613,494	592,596	1,130	2,207,220	3.02	436	210	141	787	213	167,505	13.18
Noble	1,306,778	59,797	183	1,366,758	2.63	7	205	118	330	215	70,840	19.29
Perry	3,046,231	412,927	1,318	3,460,476	4.24	1,251	364	516	2,131	186	395,592	8.75
Portage		103,472		103,472	3.88		18	8	26	320	8,330	12.42
Scioto		4,149		4,149	3.54		6		6	72	432	9.60
Stark	50,244	604,004	8,658	662,906	3.41	15	147	36	198	271	53,716	12.34
Tuscarawas	174,339	1,584,181	111,349	1,869,869	4.07	673	253	171	1,097	232	254,082	7.36
Vinton	172,628	174,600		347,228	4.74	95	109	51	255	200	52,564	6.61
Washington	128,199			128,199	3.54		38	15	53	155	8,234	15.57
Wayne	4,811	104,094	50	108,955	4.00		17	9	26	209	7,774	14.02
Total Ohio	30,160,808	8,279,095	268,375	38,708,278	4.01	13,359	4,092	4,335	21,786	206	4,497,919	8.61

1 View footnotes at end of table.

TABLE 40.—Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1948—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Production (net tons)				Average value per ton [3]	Average number of men working daily				Average number of days mines were active	Number of man-days worked	Average tons per man per day [4]
	Shipped by rail or water [1]	Shipped by truck	Used at mine [2]	Total		Underground	Surface		Total			
							In strip pits	All others				
OKLAHOMA												
Coal	208,596	24,442		233,038	$4.88	24	60	34	118	205	24,157	9.65
Craig	1,364	12,737	200	14,301	4.42		19	9	28	135	3,787	3.78
Haskell	170,940	3,379	3,052	177,371	4.26	44	50	11	105	213	22,326	7.94
Latimer	297,493	16,649		314,142	4.49	58	28	43	129	198	25,536	12.30
Le Flore	419,321	33,360		452,681	5.84	476	109	123	708	144	102,083	4.43
Muskogee	190,501	4,322		194,823	4.35		63	10	73	291	21,264	9.16
Okmulgee	1,090,376	19,944	210	1,110,530	4.68	582	53	121	756	178	134,260	8.27
Pittsburg	291,994	2,134	225	294,353	5.82	316		50	366	220	80,610	3.65
Rogers	556,897	19,556	4,800	581,253	4.36		153	86	239	256	61,218	9.49
Tulsa	72,180	5,708	54	77,942	3.61	24	20	15	59	176	10,376	7.51
Wagoner		11,750		11,750	3.11		4	2	6	118	708	16.60
Total Oklahoma	3,299,662	153,981	8,541	3,462,184	4.80	1,524	559	504	2,587	188	486,324	7.12
PENNSYLVANIA (BITUMINOUS COAL)												
Allegheny	11,272,691	3,442,719	1,498,630	16,214,040	$4.67	8,239	1,039	1,725	11,003	224	2,465,880	6.58
Armstrong	5,748,709	476,880	35,855	6,261,444	4.50	3,201	577	797	4,575	223	1,022,300	6.12
Beaver	115,465	445,129	1,475	562,069	4.54	108	134	53	295	226	66,762	8.42
Bedford	725,058	173,652	3,370	902,080	5.38	721	142	119	982	197	193,234	4.67
Blair	37,936	264,311	552	302,799	4.31	128	63	35	226	187	42,284	7.16
Bradford		8,941		8,941	4.32	3	3		6	290	1,737	5.15
Butler	1,470,396	671,977	2,059	2,144,432	4.41	802	358	213	1,373	219	300,547	7.14
Cambria	12,956,206	1,097,866	1,739,631	15,793,703	5.75	13,511	529	2,778	16,818	216	3,625,624	4.36
Cameron	12,100	8,130	25	20,255	4.35		15	1	16	197	3,150	6.43
Centre	1,201,624	382,845	1,012	1,585,481	4.60	667	333	170	1,170	204	238,916	6.64
Clarion	2,636,350	903,268	1,464	3,541,082	4.20	820	747	363	1,930	215	414,505	8.54
Clearfield	7,921,621	1,082,042	54,397	9,058,060	4.82	3,429	1,978	1,116	6,523	208	1,358,633	6.67
Clinton	140,577	372,535	1,225	514,337	3.81	76	127	41	244	211	51,376	10.01
Elk	616,377	463,843	50	1,080,270	4.65	408	320	152	880	188	165,530	6.53

Fayette	10,388,992	2,526,703	3,007,358	15,923,053	4.83	9,879	628	1,450	11,957	235	2,811,196	5.66
Forest		3,572		3,572	4.91	3		2	5	225	1,125	3.18
Fulton	118,858			118,858	6.06		20	8	28	198	5,544	21.44
Greene	12,219,565	350,912	55,654	12,626,131	5.03	7,983	170	1,450	9,603	235	2,255,267	5.60
Huntingdon	340,487	57,154	586	398,227	5.74	347	97	67	511	195	99,616	4.00
Indiana	7,171,775	842,626	645,382	8,659,783	4.99	5,195	635	1,132	6,962	213	1,484,044	5.84
Jefferson	2,155,599	540,061	39,752	2,735,412	4.45	1,345	568	361	2,274	191	434,422	6.30
Lawrence	3,229	241,258		244,487	3.84	29	52	19	100	223	22,313	10.96
Lycoming		25,020	50	25,070	4.26	22	7	2	31	198	6,125	4.09
McKean		3,008		3,008	3.48	2	3		5	166	830	3.62
Mercer	133,045	275,394	1,159	409,598	4.30	113	73	36	222	236	52,436	7.81
Somerset	6,294,014	1,228,144	34,001	7,556,159	5.23	4,708	692	1,037	6,437	214	1,377,174	5.49
Tioga	122,312	88,686	1,208	212,206	5.42	134	30	32	196	218	42,672	4.97
Venango	436,779	182,415	185	619,379	3.53	7	106	27	140	280	39,134	15.83
Washington	16,411,237	1,313,978	246,246	17,971,461	5.07	11,595	848	2,223	14,666	229	3,351,488	5.36
Westmoreland	6,103,525	1,868,701	1,074,634	9,046,860	4.79	4,883	763	986	6,632	216	1,432,607	6.31
Total Pennsylvania	106,754,527	19,341,770	8,445,960	134,542,257	4.94	78,358	11,057	16,395	105,810	221	23,366,471	5.76
SOUTH DAKOTA (LIGNITE)												
Total South Dakota	7,996	21,098		29,094	$2.96		16	2	18	212	3,820	7.62
TENNESSEE												
Anderson	1,369,055	60,938	7,964	1,437,957	$5.46	997	3	169	1,169	202	235,886	6.10
Bledsoe		5,100		5,100	3.95	13		3	16	184	2,936	1.74
Campbell	1,689,520	80,076	15,932	1,785,528	6.47	1,641	87	305	1,933	207	401,082	4.33
Claiborne	1,146,956	36,771	18,633	1,202,360	5.88	1,224	59	151	1,434	197	282,075	4.26
Cumberland		7,217		7,217	4.65	16		1	17	149	2,541	2.84
Fentress	182,942	47,904	2,008	232,854	5.06	226		31	257	202	51,941	4.48
Grundy	428,473	16,947	2,421	447,841	5.42	420	32	77	529	191	100,893	4.44
Hamilton	23,682	25,578		49,260	4.53	75		13	88	199	17,511	2.81
Marion	332,043	295,974	2,500	630,517	5.42	435	80	57	572	172	98,587	6.40
Morgan	235,285	20,325		255,610	5.96	260		50	310	225	69,782	3.66
Overton	39,833	4,690		44,523	4.83	60		8	68	160	10,913	4.08
Rhea		6,917		6,917	4.50	7		3	10	250	2,500	2.77
Scott	223,465	5,164	49	228,678	4.94	175	19	46	240	152	36,511	6.26
Sequatchie	72,322	50,633		122,955	4.88	97	31	26	154	134	20,671	5.95
Van Buren	11,035	53,993		65,028	3.81	3	16	6	25	261	6,517	9.98
White		10,666	18	10,684	3.76	27		3	30	134	4,032	2.65
Total Tennessee	5,704,611	728,893	49,525	6,483,029	5.74	5,576	327	949	6,852	196	1,341,378	4.82

See footnotes at end of table.

TABLE 40.—Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1948—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Production (net tons)				Average value per ton [3]	Average number of men working daily				Average number of days mines were active	Number of man-days worked	Average tons per man per day [4]
	Shipped by rail or water [1]	Shipped by truck	Used at mine [2]	Total		Underground	Surface		Total			
							In strip pits	All others				
TEXAS (LIGNITE)												
Total Texas	56,693			56,693	$1.02		10	6	16	265	4,240	13.37
UTAH												
Carbon	3,879,757	288,292	168,048	4,336,097	$4.71	2,260		783	3,043	220	669,178	6.48
Emery	2,236,972	81,760	14,633	2,333,365	4.29	1,080		342	1,431	224	320,071	7.29
Grand	32,300			32,300	4.68	28		5	33	257	8,481	3.81
Iron		19,858		19,858	4.55	11		3	14	280	3,913	5.07
Kane		3,145		3,145	3.00	3			3	231	692	4.54
Sevier		61,828		61,828	4.65	19		13	32	266	8,500	7.27
Summit	8,074	18,683		26,757	3.04	10		3	13	290	3,770	7.10
Total Utah	6,157,103	473,566	182,681	6,813,350	4.56	3,420		1,149	4,569	222	1,014,605	6.72
VIRGINIA												
Buchanan	4,889,834	2,800	21,818	4,914,452	$6.19	3,202	243	568	4,013	219	879,199	5.59
Dickenson	2,295,667	424	566	2,296,657	6.12	1,694		319	2,013	218	439,479	5.23
Lee	868,867	70,909	10,507	950,283	6.56	1,016		175	1,191	208	248,232	3.83
Montgomery	158,594	14,911	2,326	175,831	4.75	184		50	234	235	55,042	3.19
Russell	1,416,606	82,549		1,499,155	6.13	978	61	174	1,213	221	267,559	5.60
Scott		5,471		5,471	6.07	8			8	257	2,056	2.66
Tazewell	3,852,134	49,275	41,811	3,943,220	5.99	3,576	28	753	4,357	254	1,105,423	3.57
Wise	3,899,355	59,799	255,182	4,214,336	5.63	3,559	72	587	4,218	208	878,545	4.80
Total Virginia	17,381,057	286,138	332,210	17,999,405	6.01	14,217	404	2,626	17,247	225	3,875,535	4.64

WASHINGTON

King	187, 157	164, 619	1, 492	353, 268	$6. 29	251	48	85	384	223	85, 620	4. 13
Kittitas	562, 013	18, 414	17, 474	597, 901	6. 70	402	41	146	589	243	143, 022	4. 18
Lewis	5, 121	47, 981	223	53, 325	4. 95	54		10	64	192	12, 263	4. 35
Pierce	14, 580	3, 521	90	18, 191	7. 10	20		4	24	219	5, 244	3. 47
Thurston	58, 623	1, 997	358	60, 978	4. 54	34	13	10	57	157	8, 949	6. 81
Whatcom	114, 446	14, 742	7, 052	136, 240	7. 29	126		35	161	248	39, 926	3. 41
Total Washington	941, 940	251, 274	26, 689	1, 219, 903	6. 47	887	102	290	1, 279	231	295, 024	4. 13

WEST VIRGINIA

Barbour	3, 856, 821	19, 509	1, 539	3, 877, 869	$4. 46	1, 448	312	644	2, 404	161	380, 579	10. 03
Boone	6, 016, 491	8, 499	41, 485	6, 066, 475	5. 56	4, 016	67	1, 005	5, 088	218	1, 106, 835	5. 48
Braxton	128, 312	1, 138		129, 450	4. 14	5	16	12	33	268	8, 846	14. 63
Brooke	998, 492	311, 356	984, 537	2, 294, 385	3. 88	801	248	202	1, 251	231	288, 933	7. 94
Clay	878, 769	3, 664	31, 176	913, 609	5. 65	654		213	867	230	199, 258	4. 59
Fayette	13, 869, 138	140, 419	625, 073	14, 634, 630	6. 05	9, 973	594	1, 807	12, 374	243	3, 005, 690	4. 87
Gilmer	29, 093			29, 093	4. 05	24		3	27	142	3, 828	7. 60
Grant	28, 433	59, 997		88, 430	5. 09	70	28	14	112	169	18, 943	4. 07
Greenbrier	2, 931, 766	154, 816	16, 889	3, 103, 471	6. 45	1, 608	327	335	2, 270	222	504, 372	6. 15
Hancock	122, 631	3, 958		126, 589	4. 53	4	33	8	45	186	8, 375	15. 12
Harrison	11, 214, 607	173, 243	5, 820	11, 393, 670	4. 35	3, 556	1, 148	1, 166	5, 870	180	1, 054, 735	10. 80
Kanawha	9, 879, 278	241, 974	46, 217	10, 167, 469	5. 34	6, 836	105	1, 163	8, 104	224	1, 819, 021	5. 59
Lewis	163, 381	14, 627	9, 000	187, 008	3. 95	14	34	14	62	226	14, 002	13. 30
Lincoln	42, 674	516		43, 190	5. 60	105		12	117	83	9, 769	4. 42
Logan	22, 722, 582	517	138, 760	22, 861, 859	5. 69	12, 007	178	3, 016	15, 201	234	3, 551, 495	6. 44
Marion	9, 018, 719	376, 690	492, 830	9, 888, 239	4. 45	4, 394	111	1, 064	5, 569	237	1, 319, 088	7. 50
Marshall	616, 004	69, 161	12, 211	697, 376	4. 66	661		87	748	212	158, 832	4. 30
Mason	148, 687	45, 279	689	194, 655	5. 25	216		61	277	179	49, 615	3. 92
McDowell	23, 799, 510	78, 572	386, 872	24, 264, 954	6. 09	15, 229	230	3, 595	19, 054	254	4, 838, 951	5. 01
Mercer	3, 433, 801	18, 349	28, 520	3, 480, 170	6. 33	2, 032	248	622	2, 902	202	587, 578	5. 92
Mineral	191, 539	8, 514		200, 053	5. 83	105	49	28	182	165	29, 975	6. 67
Mingo	6, 762, 486	6, 700	40, 984	6, 810, 170	5. 76	4, 141	255	1, 003	5, 399	221	1, 193, 570	5. 71
Monongalia	11, 147, 973	414, 436	11, 234	11, 573, 643	4. 48	4, 910	230	1, 163	6, 303	211	1, 331, 116	8. 69
Nicholas	3, 530, 781	64, 117	31, 827	3, 626, 725	6. 00	2, 289	230	473	2, 992	227	678, 064	5. 35
Ohio	1, 471, 179	136, 481	14, 841	1, 622, 501	4. 74	1, 326		194	1, 520	232	352, 326	4. 61
Pocahontas		19, 810		19, 810	6. 55		8	4	12	137	1, 644	12. 05
Preston	2, 540, 405	57, 219	308, 318	2, 905, 942	5. 08	2, 077	151	505	2, 733	218	595, 281	4. 88
Putnam	43, 566	12, 917		56, 483	4. 62	14	18	9	41	130	5, 563	10. 15
Raleigh	14, 151, 645	98, 780	197, 437	14, 447, 862	6. 42	10, 471	354	2, 156	12, 981	240	3, 114, 507	4. 64
Randolph	1, 745, 397	47, 976	7, 597	1, 800, 970	5. 18	1, 112	159	271	1, 542	191	294, 130	6. 12
Taylor	1, 063, 126	21, 492	121	1, 084, 739	4. 48	281	206	123	610	143	87, 306	12. 42
Tucker	765, 801	1, 668	1, 320	768, 789	5. 66	327	156	77	560	104	108, 881	7. 06
Upshur	827, 642	30, 378	3, 251	861, 271	4. 20	405	70	113	588	199	116, 921	7. 37
Wayne	308, 727	4, 401		313, 128	5. 13	239	27	39	305	156	47, 523	6. 59
Webster	1, 729, 147	4, 097	9, 619	1, 742, 863	6. 14	1, 156	41	333	1, 530	212	324, 138	5. 38
Wyoming	6, 523, 426	9, 438	51, 342	6, 584, 206	6. 30	4, 177	184	918	5, 279	244	1, 285. 630	5. 12
Total West Virginia	162, 701, 529	2, 660, 708	3, 499, 509	168, 861, 746	5. 53	90, 688	5, 817	22, 452	124, 952	228	28, 501, 332	5. 92

See footnotes at end of table.

TABLE 40.—Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1948—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Production (net tons)				Average value per ton [3]	Average number of men working daily				Average number of days mines were active	Number of man-days worked	Average tons per man per day [4]
	Shipped by rail or water [1]	Shipped by truck	Used at mine [2]	Total		Underground	Surface		Total			
							In strip pits	All others				
WYOMING												
Campbell	224,337	26,511	12,418	263,266	$1.39		18	30	48	295	14,169	18.58
Carbon	875,223	8,468	28,720	912,411	3.75	294	49	146	489	183	89,708	10.17
Converse		13,530		13,530	3.45	2	5		7	281	1,966	6.88
Fremont		9,038	112	9,150	4.60	12		4	16	213	3,404	2.69
Hot Springs	33,505	17,175	65	50,745	6.23	71		25	96	138	13,282	3.82
Johnson		3,303	500	3,803	2.23	3		2	5	251	1,255	3.03
Lincoln	389,247	19,922	7,066	416,235	4.13	219		65	284	188	53,418	7.79
Sheridan	1,006,923	39,650	1,183	1,047,756	2.82	184	73	131	388	192	74,472	14.07
Sweetwater	3,598,082	11,623	82,102	3,691,807	4.09	2,536		596	3,132	181	566,533	6.52
Uinta		3,041		3,041	3.06	6			6	185	1,110	2.74
Total Wyoming	6,127,317	152,261	132,166	6,411,744	3.74	3,327	145	999	4,471	183	819,317	7.83
UNITED STATES												
Total United States	524,928,663	58,260,437	16,329,129	599,518,229	$4.99	330,292	32,175	79,164	441,631	217	95,703,395	6.26

[1] Includes coal loaded at mine directly into railroad cars or river barges, hauled by truck to railroad siding, and hauled by truck to waterway.
[2] Includes coal used by mine employees, taken by locomotive tenders at tipple, used at mine for power and heat, coal transported from mine to point of use by conveyor or tram, coal made into beehive coke at mine, and all other uses at mine.
[3] Value received or charged for coal, f. o. b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked [not coke] as estimated by producer at average prices that might have been received if such coal had been sold commercially.)
[4] In certain counties the average tons per man per day is large due to strip mining or mechanical loading underground.

SHIPMENTS BY RAILROAD AND WATERWAY

TABLE 41.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in 1948 [1]

Route	State	Net tons: By State	Net tons: Total for route
RAILROAD			
Alabama Central	Alabama	123,323	123,323
Alaska	Alaska	294,832	294,832
Algers, Winslow & Western	Indiana	2,454,577	2,454,577
Alton	Illinois	117,554	117,554
Artemus-Jellico	Kentucky	304,811	304,811
Atchison, Topeka & Santa Fe	Colorado	246,978	2,253,799
	Illinois	802,066	
	Kansas	292,301	
	New Mexico	912,454	
Baltimore & Ohio	Illinois	445,832	44,972,097
	Indiana	593,552	
	Maryland	96,155	
	Ohio	4,683,915	
	Pennsylvania	9,857,097	
	West Virginia	29,295,546	
Bessemer & Lake Erie	Pennsylvania	3,823,497	3,823,497
Bevier & Southern	Missouri	790,472	790,472
Brimstone	Tennessee	51,031	51,031
Buffalo Creek & Gauley	West Virginia	647,327	647,327
Cambria & Indiana	Pennsylvania	3,121,622	3,121,622
Campbell's Creek	West Virginia	868,341	868,341
Carbon County	Utah	1,689,555	1,689,555
Central of Georgia	Alabama	721,587	741,587
	Georgia	20,000	
Chesapeake & Ohio	Kentucky	13,479,032	68,056,523
	Ohio	1,244,683	
	West Virginia	53,332,808	
Cheswick & Harmar	Pennsylvania	854,390	854,390
Chicago, Burlington & Quincy	Colorado	73,516	13,289,192
	Illinois	11,705,071	
	Iowa	235,523	
	Missouri	10,317	
	Wyoming	1,264,765	
Chicago & Eastern Illinois	Illinois	1,081,204	2,701,253
	Indiana	1,620,049	
Chicago & Illinois Midland	Illinois	7,934,469	7,934,469
Chicago, Indianapolis & Louisville	Indiana	575,795	575,795
Chicago, Milwaukee, St. Paul & Pacific	do	5,852,872	6,723,722
	Iowa	132,044	
	Missouri	4,376	
	Montana (bituminous)	686,771	
	North Dakota (lignite)	39,663	
	South Dakota (lignite)	7,996	
Chicago & North Western	Illinois	2,554,162	2,554,162
Chicago, Rock Island & Pacific	Arkansas	37,237	1,364,840
	Illinois	663,729	
	Iowa	134,956	
	Missouri	[illegible]	
	Oklahoma	306,324	
Clinchfield	Virginia	4,028,240	4,028,240
Colorado & Southeastern	Colorado	5,795	5,795
Colorado & Southern	do	430,113	430,113
Colorado & Wyoming	do	541,492	541,492
Conemaugh & Black Lick	Pennsylvania	69,083	69,083
Cumberland & Pennsylvania	Maryland	462,601	515,051
	West Virginia	52,450	
Dardanelle & Russellville Ry. Co.	Arkansas	57,341	57,341
Denver & Intermountain	Colorado	89,190	89,190
Denver & Rio Grande Western	do	2,166,229	5,018,440
	New Mexico	22,963	
	Utah	2,829,248	
Detroit, Toledo & Ironton	Ohio	39,026	39,026
East Broad Top R. R. & Coal Co.	Pennsylvania	549,040	549,040
Erie	Ohio	140,290	929,980
	Pennsylvania	789,690	
Fort Dodge, Des Moines & Southern	Iowa	25,925	25,925
Fort Smith & Van Buren	Oklahoma	212,621	212,621
Galesburg & Great Eastern	Illinois	600,391	600,391
Great Northern	North Dakota (lignite)	538,181	652,627
	Washington	114,446	

See footnotes at end of table.

TABLE 41.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in 1948[1]—Con.

Route	State	Net tons: By State	Net tons: Total for route
RAILROAD—continued			
Gulf, Mobile & Ohio	Alabama	264,138	2,244,434
	Illinois	1,980,296	
Huntingdon & Broad Top Mountain R. R. & Coal Co.	Pennsylvania	635,363	635,363
Illinois Central	Alabama	166,743	22,815,343
	Illinois	10,612,528	
	Indiana	376,270	
	Kentucky	11,659,802	
Illinois Terminal	Illinois	315,923	315,923
Interstate	Kentucky	170,917	2,669,582
	Virginia	2,498,665	
Johnstown & Stony Creek	Pennsylvania	240,956	240,956
Joplin-Pittsburg	Kansas	147,953	147,953
Kanawha Central	West Virginia	165,994	165,994
Kansas City Southern	Arkansas	84,825	1,216,162
	Kansas	263,852	
	Missouri	707,801	
	Oklahoma	159,684	
Kansas, Oklahoma & Gulf	Oklahoma	1,363	1,363
Kelley's Creek & Northwestern	West Virginia	1,153,289	1,153,289
Kentucky & Tennessee	Kentucky	633,813	633,813
Lake Erie, Franklin & Clarion	Pennsylvania	274,062	274,062
Laramie, North Park & Western	Colorado	4,090	4,090
Ligonier Valley	Pennsylvania	168,488	168,488
Litchfield & Madison	Illinois	717,703	717,703
Louisville & Nashville	Alabama	3,836,421	41,567,745
	Illinois	159,620	
	Kentucky	35,876,710	
	Tennessee	1,307,620	
	Virginia	387,374	
Mary Lee	Alabama	709,731	709,731
Midland Valley	Arkansas	280,875	713,869
	Oklahoma	432,994	
Minneapolis & St. Louis	Illinois	2,238,482	2,262,807
	Iowa	24,325	
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota (lignite)	681,342	681,342
Missouri-Illinois	Illinois	90,027	90,027
Missouri-Kansas-Texas	Kansas	285,650	798,901
	Missouri	232,088	
	Oklahoma	281,163	
Missouri Pacific	Arkansas	794,569	8,490,717
	Illinois	6,469,396	
	Kansas	891,217	
	Missouri	98,867	
	Oklahoma	236,668	
Monongahela	Pennsylvania	4,994,349	15,610,907
	West Virginia	10,616,558	
Montana, Wyoming & Southern	Montana (bituminous)	221,522	221,522
Montour	Pennsylvania	5,079,773	5,079,773
Nashville, Chattanooga & St. Louis	Alabama	2,723	801,482
	Tennessee	798,759	
New York Central (includes coal shipped over Kanawha & Michigan, Kelley's Creek, Toledo and Ohio Central, and Zanesville & Western)	Illinois	4,870,734	23,931,920
	Indiana	3,453,745	
	Ohio	6,720,076	
	Pennsylvania	7,099,090	
	West Virginia	1,788,275	
Nicholas, Fayette & Greenbrier	West Virginia	2,812,447	2,812,447
Norfolk & Western	Kentucky	7,197,170	50,784,380
	Virginia	9,405,625	
	West Virginia	34,181,585	
Northeast Oklahoma	Kansas	5,300	5,300
Northern Pacific	Montana (bituminous)	1,890,398	3,768,926
	North Dakota (lignite)	1,147,733	
	Washington	730,795	
Oklahoma City-Ada-Atoka	Oklahoma	208,596	208,596
Oneida & Western	Tennessee	7,477	7,477
Pacific Coast	Washington	37,428	37,428
Pennsylvania (includes Pittsburgh, Cincinnati, Chicago & St. Louis)	Illinois	145,125	55,339,882
	Indiana	4,802,933	
	Ohio	8,427,363	
	Pennsylvania	41,059,527	
	West Virginia	904,934	
Peoria Terminal	Illinois	390,416	390,416
Pittsburgh & Lake Erie	Pennsylvania	1,325,504	1,325,504
Pittsburg & Shawmut	do	3,184,447	3,184,447
Pittsburgh, Chartiers & Youghiogheny	do	69,062	69,062

See footnotes at end of table.

TABLE 41.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in 1948[1]—Con.

Route	State	Net tons: By State	Net tons: Total for route
RAILROAD—continued			
Pittsburgh & West Virginia	Ohio	569,669	1,798,059
	Pennsylvania	1,033,551	
	West Virginia	194,839	
Preston	West Virginia	91,655	91,655
Rockdale, Sandow & Southern	Texas (lignite)	56,693	56,693
St. Louis & O'Fallon	Illinois	379,521	379,521
St. Louis-San Francisco	Alabama	2,136,161	5,208,412
	Arkansas	381,195	
	Kansas	470,011	
	Missouri	762,796	
	Oklahoma	1,458,249	
Southern	Alabama	3,060,954	8,719,571
	Illinois	88,118	
	Indiana	1,682,534	
	Kentucky	1,024,631	
	Tennessee	1,960,765	
	Virginia	902,569	
Southern Iowa	Iowa	23,131	23,131
Southern Pacific	New Mexico	343,103	343,103
Springfield Terminal	Illinois	769,527	769,527
Tennessee	Tennessee	1,342,756	1,342,756
Tennessee Central	do	39,833	39,833
Tennessee Coal, Iron & Railroad Co	Alabama	3,570,908	3,570,908
Thomas & Sayreton	do	510,812	510,812
Union	Pennsylvania	358,113	358,113
Union Pacific	Colorado	598,221	5,518,118
	Utah	8,074	
	Washington	59,271	
	Wyoming	4,852,552	
Unity	Pennsylvania	607,709	607,709
Utah	Utah	1,630,226	1,630,226
Virginian	Virginia	158,594	15,396,385
	West Virginia	15,237,791	
Wabash	Illinois	1,312,619	1,916,508
	Iowa	133,782	
	Missouri	470,107	
West Virginia Northern	West Virginia	926,054	926,054
Western Allegheny	Pennsylvania	813,609	813,609
Western Maryland	Maryland	690,380	6,967,103
	Pennsylvania	604,777	
	West Virginia	5,671,946	
Wheeling & Lake Erie	Ohio	7,664,243	7,664,243
Winifrede	West Virginia	173,313	173,313
Woodward Iron Co	Alabama	956,406	956,406
Youngstown & Suburban	Ohio	39,877	39,877
Total railroad shipments		498,193,877	498,193,877
WATERWAY			
Allegheny River	Pennsylvania	1,173,287	1,173,287
Black Warrior River	Alabama	37,087	37,087
Emory River	Tennessee	151,256	151,256
Illinois River	Illinois	756,567	756,567
Kanawha River	West Virginia	2,328,629	2,328,629
Monongahela River	Pennsylvania	18,924,674	20,484,347
	West Virginia	1,559,673	
Ohio River	Kentucky	446,981	1,719,722
	Ohio	631,666	
	West Virginia	642,075	
Tennessee River	Tennessee	45,114	45,114
Youghiogheny River	Pennsylvania	38,777	38,777
Total waterway shipments		26,734,786	26,734,786
Total loaded at mines for shipment by railroads and waterways		524,928,663	524,928,663
Shipped by truck		58,260,427	58,260,427
Used at mine [2]		16,329,129	16,329,129
Total production 1948		599,518,219	599,518,219

[1] Includes coal loaded at mine directly into railroad cars or river barges, hauled by truck to railroad siding and hauled by truck to waterway. In general, figures show the quantity of bituminous coal and lignite originated for each railroad and waterway as reported by mine operators. It must be noted that in one year an operator may report coal loaded on the subsidiary railroad and in another year the same operator may report coal loaded on the parent railroad system.

[2] Includes coal used by mine employees, taken by locomotive tenders at tipple, used at mine for power and heat, coal transported from mine to point of use by conveyor or tram, coal made into beehive coke at mine, and all other uses at mine.

STATISTICS ON LIGNITE IN 1948 [3]

According to reports received by the Bureau of Mines, the production of lignite in the United States in 1948 (exclusive of small mines producing less than 1,000 tons) totaled 3,085,886 net tons, an increase of 7 percent over 1947, and the highest production since 1937. The average value increased from $1.92 per ton in 1947 to $2.27 in 1948. The average number of men employed totaled 694, a slight decline from the 747 men working in 1947, and the output per man per day (based upon calculated man-days) was 17.53 tons in 1948. The industry worked an average of 254 days in 1948, compared with 250 in the preceding year. North Dakota produced 96 percent of the total lignite mined in the United States; California, Montana, South Dakota, and Texas, together accounted for the remaining 4 percent.

According to the Federal Power Commission, 1,150,716 tons of lignite were consumed in generating electric energy in 1948; this amounts to 37 percent of the total lignite mined in the United States in that year. Consumption in the West North Central States was 1,121,853 tons; the West South Central and Mountain States consumed 28,863 tons.

All data are submitted on a voluntary basis by producers of lignite, and the Bureau of Mines wishes to thank them for their cooperation in supplying the data, without which this report would not have been possible.

TABLE 42.—Summary of production, value, employment, days operated, man-days of labor, and output per man per day at lignite mines in the United States in 1948, by States [1]

	California	Montana [2]	North Dakota	South Dakota	Texas	Total
Production (net tons):						
Loaded at mines for shipment			2,406,919	7,996	56,693	2,471,608
Commercial sales by truck or wagon	1,450	37,571	472,586	21,098		532,705
Used by employees, taken by locomotives at tipple, and other uses		89	[3] 64,433			64,522
Used at mine for power and heat			17,051			17,051
Total production:						
1948	1,450	37,660	2,960,989	29,094	56,693	3,085,886
1947		38,669	2,759,862	14,618	60,504	2,873,653
Value of production:						
Total:						
1948	$14,500	$124,322	$6,729,426	$86,208	$58,034	$7,012,490
1947		$112,198	$5,312,084	$35,727	$59,293	$5,519,302
Average per ton:						
1948	$10.00	$3.30	$2.27	$2.96	$1.02	$2.27
1947		$2.90	$1.92	$2.44	$0.98	$1.92
Number of men working daily:						
Underground		26	135			161
Surface (including strip pits)	4	10	485	18	16	533
Total:						
1948	4	36	620	18	16	694
1947		37	680	15	15	747
Average number of days mines operated:						
1948	82	175	260	212	265	254
1947		185	255	176	240	250
Man-days of labor: 1948	328	6,295	161,388	3,820	4,240	176,071
Average tons per man per day: 1948	4.42	5.98	18.35	7.62	13.37	17.53

[1] Exclusive of small mines producing less than 1,000 tons.
[2] Including output from Custer, Dawson, Richland, Roosevelt, and Sheridan Counties.
[3] Includes some lignite made into briquets.

[3] Compiled by J. A. Corgan and M. I. Cooke.

TABLE 43.—Production, value, employment, days operated, man-days of labor, and output per man per day at lignite mines in the United States in 1948, by States and counties

County	Total production (net tons)	Value of production		Average number of men working daily	Man-days of labor	Average number of days mine operated	Average tons per man per day
		Total	Average per ton				
CALIFORNIA							
Total California (Amador County)	1,450	$14,500	$10.00	4	328	82	4.42
MONTANA							
Custer	10,751	$36,896	$3.43	11	1,860	169	5.78
Dawson	2,828	8,433	2.98	4	624	156	4.53
Richland	8,472	29,465	3.48	6	1,164	194	7.28
Roosevelt	4,604	18,416	4.00	6	1,050	175	4.38
Sheridan	11,005	31,112	2.83	9	1,597	177	6.89
Total Montana	37,660	124,322	3.30	36	6,295	175	5.98
NORTH DAKOTA							
Adams	67,954	$177,747	$2.62	18	4,671	260	[1] 14.55
Bowman	4,922	13,496	2.74	5	1,000	200	4.92
Burke	350,974	866,514	2.47	56	14,909	266	[1] 23.54
Burleigh	6,654	22,088	3.32	9	2,140	238	3.11
Divide	223,472	542,643	2.43	46	11,263	245	[1] 19.84
Dunn	6,390	16,825	2.63	3	600	200	[1] 10.65
Golden Valley	3,283	8,708	2.65	4	540	135	6.08
Grant	18,778	56,449	3.01	12	1,530	128	[1] 12.27
Hettinger	12,374	38,112	3.08	8	1,036	130	[1] 11.94
McKenzie	4,151	12,942	3.12	5	840	168	4.94
McLean	346,411	778,062	2.25	59	15,825	268	[1] 21.89
Mercer	1,246,497	2,637,702	2.12	216	58,394	270	[1] 21.35
Morton	28,184	69,222	2.46	12	2,226	186	[1] 12.66
Oliver	4,444	10,850	2.44	3	480	160	[1] 9.26
Stark	93,718	192,337	2.05	38	12,321	324	7.61
Ward	519,563	1,217,659	2.34	107	30,708	287	[1] 16.92
Williams	23,220	68,041	2.93	19	2,905	153	7.99
Total North Dakota	2,960,989	6,729,426	2.27	620	161,388	260	18.35
SOUTH DAKOTA							
Corson	1,804	$5,412	$3.00	4	320	80	5.64
Dewey	27,290	80,796	2.96	14	3,500	250	7.80
Total South Dakota	29,094	86,208	2.96	18	3,820	212	7.62
TEXAS							
Total Texas (Milam County)	56,693	$58,034	$1.02	16	4,240	265	[1] 13.37
UNITED STATES							
Total United States	3,085,886	$7,012,496	$2.27	694	176,071	254	17.53

[1] Output is obtained chiefly from strip pits in which the production per man per day is large.

In 1948, the Bureau of Mines received reports from 52 lignite mines producing 1,000 tons or more annually. Seven mines produced over 100,000 tons, and the output of these mines amounted to 82 percent of the total production, 4 reported production of 50,000 to 100,000 tons each and accounted for 8 percent of the total, and 41 mines producing less than 50,000 tons accounted for 10 percent of the total.

TABLE 44.—Number and production of lignite mines in the United States in 1948, classified by size of output

Class	Mines		Production		
			Net tons		Percent of total
	Number	Percent	Total	Average per mine	
100,000 tons and over	7	13.5	2,530,397	361,485	82
50,000 and under 100,000	4	8	262,207	65,552	8
10,000 and under 50,000	7	13.5	142,840	20,406	5
Under 10,000 tons	34	65	150,442	4,425	5
Total	52	100	3,085,886	59,344	100

TABLE 45.—Lignite mined by different methods in the United States in 1948, by States, in net tons

Method	California	Montana	North Dakota	South Dakota	Texas	Total
From underground workings:						
Shot off the solid		36,081	23,036			59,117
Cut by machines [1]			461,795			461,795
Total underground		36,081	484,831			520,912
From strip pits	1,450	1,579	2,476,158	29,094	56,693	2,564,974
Grand total production	1,450	37,660	2,960,989	29,094	56,693	3,085,886

[1] A total of 6 machines was used—1 "permissible" and 5 other types.

The production of lignite from strip pits amounts to 2,564,974 tons—83 percent of the total output of the industry. North Dakota produced 97 percent of the lignite mined by this method; the output of lignite from stripping operations for the other four States amounted to only 88,816 tons.

TABLE 46.—Summary of stripping operations that produced lignite in the United States in 1948, by States

	California	Montana	North Dakota	South Dakota	Texas	Total
Number of strip pits [1]	1	1	30	2	1	35
Number of shovels, dragline excavators, and coal-loading machines [2]			44	2	1	47
Coal produced by stripping	1,450	1,579	2,476,158	29,094	56,693	2,564,974
Total production value at mines	$14,500	$4,737	$5,706,679	$86,208	$58,034	$5,870,158
Average value per ton	$10.00	$3.00	$2.30	$2.96	$1.02	$2.29
Number of employees:						
In strip pits	4	2	239	16	10	271
All others		2	195	2	6	205
Total	4	4	434	18	16	476
Average number of days mines operated	82	43	258	212	265	254
Man-days of labor	328	172	112,125	3,820	4,240	120,685
Average tons per man per day	4.42	9.18	22.08	7.62	13.37	21.25

[1] Includes some pits in which stripping is done by hand.
[2] In some cases the same equipment was used for stripping or excavating and for loading coal; this duplication has been eliminated. In some cases coal was excavated by machine and loaded by hand.

FOREIGN TRADE [4]

TABLE 47.—Bituminous coal [1] imported for consumption in the United States, 1947–49, by countries and customs districts, in net tons

[U. S. Department of Commerce]

Country	1947	1948	1949
North America:			
Canada	288, 394	289, 839	311, 801
Mexico	114	1, 148	165
South America: Colombia	6		
Europe:			
Greece			13
Italy			6
Netherlands	130		
Poland and Danzig	1, 120		
United Kingdom	349	350	2, 995
Africa: Union of South Africa	28		
Total	290, 141	291, 337	314, 980

Customs district	1947	1948	1949
Alaska	7, 372	5, 755	7, 535
Chicago	6		6
Dakota	758	868	1, 438
Duluth and Superior		42	186
Florida	60		
Galveston		1, 193	
Hawaii	64		8, 831
Laredo	114		165
Maine and New Hampshire	45, 418	112, 269	137, 033
Massachusetts		193	
Michigan	864	148	538
Mobile			2, 995
Montana and Idaho	213, 313	153, 777	143, 926
New Orleans		200	
New York	1, 927		144
Rochester		55	
St. Lawrence	77	(2)	
Vermont	2, 099	1, 403	115
Washington	18, 069	15, 434	12, 068
Total	290, 141	291, 337	314, 980

[1] Includes slack, culm, and lignite.
[2] Less than 1 ton.

TABLE 48.—Exports of bituminous coal, by country groups, 1945–49, in thousands of net tons

[U. S. Department of Commerce]

Year	Canada and Mexico	West Indies and Central America [1]	"Overseas" (all other countries): Newfoundland, Miquelon, Bermuda, Greenland, and Iceland	South America	Europe	Asia	Africa	Oceania	Total "overseas"	Grand total
1945	21, 589	295	191	1, 080	3, 924	(2)	873	4	6, 072	27, 956
1946	21, 882	253	160	1, 723	16, 065	201	878	37	19, 064	41, 199
1947	25, 849	369	404	2, 866	[3] 36, 703	311	2, 057	108	[3] 42, 449	[3] 68, 667
1948	25, 845	214	159	1, 867	[4] 16, 093	765	961	26	[4] 19, 871	[4] 45, 930
1949	15, 984	140	122	819	8, 682	1, 395	612	88	11, 718	27, 842

[1] Includes Bahamas and Panama.
[2] Less than 1,000 net tons.
[3] Excludes 102,179 tons ($1,010,820) exported to Austria as a part of the Army Civilian Supply Program.
[4] Revised figure.

[4] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 49.—Bituminous coal exported from the United States, 1947–49, by countries, in net tons [1]

[U. S. Department of Commerce]

Country	1947	1948	1949
North America:			
Bermuda	14,567	3,508	731
Canada	25,848,117	25,842,797	15,982,038
Central America:			
British Honduras	30	4	45
Canal Zone	34,342	22,207	9,051
Costa Rica	50	3,177	42
El Salvador	128	86	176
Guatemala	257	230	140
Honduras	302	293	276
Nicaragua	8		
Panama, Republic of	35	45	20
Greenland	4,493		
Iceland	57,627		
Mexico	694	1,593	1,617
Miquelon and St. Pierre	4,864	500	4,697
Newfoundland and Labrador	321,553	154,932	115,797
West Indies:			
British:			
Barbados	2,574	1,225	
Jamaica	89,339	48,890	32,465
Leeward and Windward	14,800		
Trinidad and Tobago	100,797	57,675	33,502
Other British	491	5	
Cuba	98,277	76,471	55,907
Dominican Republic	7,309	625	106
French	20,448	1,910	9,330
Haiti	2	15	15
Netherlands Antilles	374	2,004	137
Total North America	26,621,478	26,218,192	16,246,092
South America:			
Argentina	1,113,734	826,750	30,625
Bolivia	329	511	15,288
Brazil	1,468,312	959,323	681,838
Chile	163,693	27,634	29,472
Surinam	2,570	3,875	2,510
Uruguay	117,135	48,705	58,628
Other South America	500	276	321
Total South America	2,866,273	1,867,074	818,682
Europe:			
Austria	[2] 122,391	58,447	
Belgium and Luxembourg	3,363,800	630,604	
Denmark	2,377,583	52,098	
Finland	637,271	6,273	
France	12,466,388	[2] 8,459,268	3,639,516
Germany	42,630	70,777	
Gibraltar	156,872		
Greece	34,056	62,830	
Ireland	1,005,584	8	
Italy	8,780,259	4,696,415	3,912,139
Netherlands	2,691,248	770,761	310,961
Norway	738,735		
Portugal	846,901	257,230	184,275
Sweden	2,074,092	587,322	437,012
Switzerland	683,400	420,621	186,655
United Kingdom	675,043		
Other Europe	6,966	20,117	11,226
Total Europe	[2] 36,703,219	[2] 16,092,771	8,681,784
Asia:			
China	4,234	40,078	40,002
French Indochina	2,520		
Hong Kong	92,203		
India	10	32,376	
Japan		688,776	1,355,102
Indonesia	95,417		
Malaya	99,519		
Palestine and Israel	3,436		
Syria	13,667		
Other Asia	23	3,934	10
Total Asia	311,029	765,164	1,395,114

See footnotes at end of table, p. 339.

TABLE 49.—Bituminous coal exported from the United States, 1947–49, by countries, in net tons [1]—Continued

Country	1947	1948	
Africa:			
Algeria	1,052,370	556,686	265,576
Belgian Congo	14,151		
British West Africa	36,425		
Canary Islands	51,822	2,082	
Cape Verde Islands	89,354		
Egypt	298,135	27,596	
French Cameroon	140	17,206	22,740
French Equatorial Africa		10,827	46,517
French West Africa	244,643	132,668	84,595
Libya	27,083		
Madagascar		10,918	55,273
Madeira Islands	21,491		
Morocco, French	92,020	169,551	127,753
Spanish Africa	114,311	22,481	
Tunisia	14,531		9,291
Other Africa	935	10,726	6
Total Africa	2,057,411	960,740	611,751
Oceania	107,553	26,192	88,633
Grand total	[2] 68,666,963	[3] 45,930,133	27,842,066

[1] Amounts stated do not include fuel or bunker coal loaded on vessels engaged in foreign trade, which aggregated 1,689,328 tons in 1947, 1,057,118 tons in 1948, and 874,029 tons in 1949.
[2] Exclusive of 102,179 tons exported to Austria as a part of the Army Civilian Supply Program.
[3] Revised figure.

TABLE 50.—Bituminous coal exported from the United States, 1947–49, by customs districts, in net tons

Customs district	1947	1948	1949
North Atlantic:			
Maine and New Hampshire	57,408	5,586	6,276
Massachusetts	61		68
New York	1,382,037	23,788	7,196
Philadelphia	2,740,855	453,540	32,150
South Atlantic:			
Georgia	10,706		560
Maryland	10,871,709	3,471,674	1,336,249
South Carolina	1,825,197	768,520	54,450
Virginia	20,146,083	[1] 13,827,771	10,061,387
Gulf coast:			
Florida	2,015,102	330,455	3,501
Galveston	463,494		
Mobile	1,427,881	617,042	26,388
New Orleans	315,944	7,968	1,569
Sabine	731,418		
Mexican border:			
Arizona	272	273	265
El Paso	45	1,138	1,317
Laredo	27		
Pacific coast:			
Los Angeles	142,522	100	
Oregon	378,229	10,962	
San Diego	83	125	10
San Francisco	20	69	115
Washington	301,035	134,461	37,929
Northern border:			
Buffalo	1,548,629	1,103,124	744,288
Chicago	1,506,335	1,633,134	711,818
Dakota	23,392	36,373	50,210
Duluth and Superior	385,936	340,995	204,062
Michigan	3,046,644	3,127,640	2,245,509
Montana and Idaho	4,431	723	1,284
Ohio	11,619,905	13,314,027	8,763,969
Rochester	3,839,918	3,465,712	1,795,570
St. Lawrence	3,677,266	2,815,519	1,473,782
Vermont	4,106	5,041	1,575
Wisconsin	193		
Miscellaneous	18,663	283	84
Total	[2] 68,666,963	[2] 45,930,133	[2] 27,842,066

[1] Revised figure.
[2] Includes 192,905 tons in 1947, 434,070 tons in 1948, and 277,555 tons in 1949, representing shipments on vessels operated by the United States Army or Navy. Excludes 102,179 tons exported to Austria in 1947 as a part of the Army Civilian Supply Program.

TABLE 51.—Shipments of bituminous coal to noncontiguous Territories, 1947–49

[U. S. Department of Commerce]

Territory	1947		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value
Alaska [1]	6,860	$112,272	(2)	(2)	(2)	(2)
Hawaii	365	10,135	(2)	(2)	(2)	(2)
Puerto Rico	9,148	78,593	1,500	$15,607	4,999	$48,366
Virgin Islands	44,514	334,149	25,799	264,564	20,601	196,211

[1] Includes shipments of anthracite.
[2] Beginning Apr. 1, 1948, no data available.

WORLD PRODUCTION

TABLE 52.—World production of coal and lignite, by countries, 1942–49, in thousands of metric tons [1]

[Compiled by Berenice B. Mitchell and Pauline Roberts]

Country [1]	1942	1943	1944	1945	1946	1947	1948	1949
North America:								
Canada:								
Coal	[2] 15,932	[2] 14,689	14,201	13,584	14,776	12,971	15,296	15,640
Lignite	[2] 1,181	[2] 1,512	1,245	1,391	1,382	1,425	1,442	1,696
Greenland	5	7	8	7	8	7	8	(3)
Mexico	914	1,025	904	915	977	1,055	1,057	[4] 1,028
United States:								
Anthracite (Pennsylvania)	54,728	55,015	57,789	49,835	54,891	51,882	51,836	38,704
Bituminous	525,948	532,903	559,750	521,582	481,943	569,482	541,072	391,898
Lignite	2,659	2,494	2,317	2,421	2,420	2,607	2,799	2,725
South America:								
Argentina [5]	5	8	5	3	3	14	(3)	(3)
Brazil:								
Coal	1,354	1,537	1,415	1,492	1,274	1,996	[4] 2,013	[4] 2,140
Lignite	17	23	16	9	(3)	(3)	(3)	(3)
Chile	1,782	2,032	2,047	1,827	1,740	1,850	2,019	[4] 1,800
Colombia	578	483	499	534	551	505	[4] 900	(3)
Peru	149	187	173	201	230	215	189	200
Venezuela	9	11	9	7	4	[4] 15	21	(3)
Europe:								
Albania: Lignite [4]	20	10	5	5	12	20	(3)	(3)
Austria:								
Coal	225	214	195	72	108	178	181	183
Lignite	3,523	3,646	3,674	2,066	2,407	2,839	3,338	3,816
Belgium	25,055	23,737	13,529	15,833	22,852	24,390	26,679	27,850
Bulgaria:								
Coal	220	204	125	128	93	120	(3)	(3)
Lignite	3,448	3,812	2,890	3,435	3,420	4,011	[4] 4,250	(3)
Czechoslovakia:								
Coal	22,635	24,500	23,159	11,716	14,167	16,216	17,746	17,003
Lignite	23,316	26,750	26,112	15,356	19,475	22,362	23,589	26,526
Denmark: Lignite	1,800	2,600	2,200	2,320	2,300	2,800	2,347	1,426
France:								
Coal	41,869	40,531	25,241	33,313	47,185	45,229	43,291	51,199
Lignite	1,958	1,896	1,336	1,704	2,104	2,094	1,838	1,845
Saar	(3)	(3)	(3)	(3)	7,887	10,485	12,567	14,262
Germany:								
Coal	251,970	158,616	135,336	[6] 23,610	65,667	85,771	91,246	[4] 108,000
Lignite	244,643	254,604	230,808	107,248	159,924	160,595	175,736	[4] 190,000
Greece: Lignite	365	370	190	70	125	133	125	(3)
Hungary:								
Coal	1,250	1,376	[7] [8] 1,050	[7] 711	722	1,059	1,238	[4] 1,380
Lignite	11,720	11,296	[7] [8] 8,400	[7] 3,574	5,630	7,750	9,360	[4] 10,436
Ireland	167	186	206	216	216	221	182	115
Italy:								
Coal	2,512	1,358	613	758	1,178	1,358	975	1,104
Lignite	2,366	1,934	496	767	1,521	1,851	904	832
Netherlands:								
Coal	12,330	12,497	8,313	5,097	8,314	10,104	11,032	11,703
Lignite	281	383	243	130	499	474	279	[4] 207
Poland:								
Coal	[8] 83,972	[8] 91,362	[8] 87,389	27,366	47,288	59,130	70,262	69,900
Lignite	(3)	(3)	(3)	(3)	857	4,766	5,040	[4] 4,585

See footnotes at end of table.

TABLE 52.—World production of coal and lignite, by countries, 1942–49, in thousands of metric tons [1]—Continued

Country [1]	1942	1943	1944	1945	1946	1947	1948	1949
Europe—Continued								
Portugal:								
Coal	498	403	426	436	380	370	387	444
Lignite	108	106	127	163	141	108	103	111
Rumania:								
Coal	285	306	202	211	167	163	} 2,631	[4] 191
Lignite	2,367	2,604	2,069	1,820	1,784	2,105		[4] 2,378
Spain:								
Coal	9,257	9,591	10,485	10,732	10,759	10,606	10,627	10,641
Lignite	1,106	1,112	1,202	1,351	1,336	1,263	1,400	1,321
Svalbard (Spitsbergen)	------	------	------	6	96	337	437	[4] 500
Sweden	582	557	570	615	488	416	374	311
Switzerland:								
Coal	184	157	71	180	94	15	------	------
Lignite	27	75	74	130	81	12	------	------
U. S. S. R.:								
Coal	} [4] 90,000	[4] 131,400	[4] 118,000	[4] 146,000	} [4] 161,000	[4] 175,000	[4] 201,000	[4] 226,000
Lignite			(3)	(3)				
United Kingdom:								
Great Britain [10]	208,234	202,113	195,840	185,707	193,117	200,615	211,772	217,161
Northern Ireland:								
Coal	(11)	(11)	(11)	(11)	(11)	1	1	(3)
Lignite	1	1	2	3	(11)	(11)	(11)	(3)
Yugoslavia:								
Coal	} [12] [13] 1,160	1,390	(3)	206	757	1,062	} 11,500	[4] 12,900
Lignite				3,405	6,047	8,229		
Asia:								
Afghanistan	5	------	------	12	5	5	[20] 15	(3)
China:								
Coal	[4] 65,267	} [4] 62,713	[4] 62,465	16,576	11,475	14,148	[4] 8,720	[4] 16,000
Lignite	419			(3)	(3)	(3)	(3)	(3)
Formosa	2,311	2,324	1,653	795	1,058	1,289	[4] 1,500	1,649
French Indochina:								
Coal	1,218	996	583	231	262	243	359	385
Lignite	24	25	4	------	------	------	------	------
India	29,906	25,921	26,546	29,635	30,186	28,882	30,303	[4] 31,760
Indonesia	872	1,038	753	308	157	290	[14] 537	[4] 590
Iran [15]	82	60	100	[4] 150	[4] 150	188	(3)	(3)
Japan:								
Coal	[16] 54,179	[16] 55,539	[16] 49,335	[16] 22,371	20,376	27,235	33,725	37,909
Lignite	[16] 1,607	[16] 2,876	[16] 2,304	[16] 1,643	2,352	2,820	2,552	[4] 2,095
Karafuto	[4] 7,000	7,500	8,000	(3)	(3)	(3)	(3)	(3)
Korea:								
North Korea:								
Coal	2,692	2,939	3,132	34	[4] 821	[4] 1,352	(3)	(3)
Lignite	2,927	2,386	2,492	1	[4] 432	[4] 1,616	(3)	(3)
South Korea:								
Coal	1,206	1,218	1,398	640	251	493	799	1,066
Lignite	31	44	27	17	26	37	68	60
Malaya	249	497	416	230	228	230	381	393
Pakistan	(17)	(17)	(17)	(17)	(17)	340	250	[4] 325
Philippines	(3)	(3)	(3)	(3)	48	74	88	123
Syria and Lebanon:								
Lignite	7	1	2	2	(11)	------	(11)	(3)
Turkey:								
Coal	2,510	2,071	2,383	2,150	2,312	2,623	2,669	2,705
Lignite	409	414	533	571	484	628	829	[4] 937
U. S. S. R.:								
Coal	} (18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)
Lignite								
Africa:								
Algeria:								
Coal	148	117	120	162	215	205	226	257
Lignite	7	1	1	(3)	(3)	(3)	(3)	(3)
Belgian Congo	43	70	49	50	103	102	117	(3)
French Morocco	119	162	134	179	222	268	290	347
Madagascar	2	1	2	3	(11)	------	(3)	(3)
Mozambique	7	13	16	12	16	16	16	(3)
Nigeria	[19] 471	[19] 537	651	679	648	591	[20] 618	[20] 559
Southern Rhodesia	1,561	1,779	1,808	1,669	1,613	1,508	1,695	1,918
Tunisia: Lignite	141	41	66	69	95	76	71	[4] 47
Union of South Africa	20,408	20,561	22,987	23,554	23,601	23,818	24,017	[21] 25,010

See footnotes at end of table.

TABLE 52.—World production of coal and lignite by countries, 1942–49 in thousands of metric tons [1]—Continued

Country [1]	1942	1943	1944	1945	1946	1947	1948	1949
Oceania:								
Australia:								
New South Wales	12,433	11,714	11,280	10,402	11,397	11,896	11,909	10,910
Queensland	1,663	1,727	1,686	1,661	1,593	1,914	1,770	[22] 1,352
South Australia	2		35	42	138	196	243	[22] 280
Tasmania	137	148	146	151	161	170	182	[22] 126
Victoria:								
Coal	318	292	262	251	194	176	170	[22] 84
Lignite	5,013	5,173	5,097	5,533	5,799	6,239	6,800	[22] 5,713
Western Australia	591	540	567	552	653	742	745	764
New Zealand:								
Coal	1,194	1,157	1,085	980	974	951	968	937
Lignite	1,529	1,676	1,766	1,899	1,865	1,845	1,853	1,874
Total, all grades	1,874,000	1,838,000	1,765,000	1,338,000	1,477,000	1,649,000	1,706,000	1,632,000
Lignite (total of items shown above)	313,000	328,000	309,000	168,000	222,000	238,000	246,000	263,000
Bituminous coal and anthracite (by subtraction)	1,561,000	1,510,000	1,456,000	1,170,000	1,255,000	1,411,000	1,460,000	1,369,000

[1] Coal is also mined in British Borneo, Faroe Islands, and Italian East Africa (formerly), but production figures are not available and no estimate is included in the total.
[2] A change from previous years has been made in the classification adopted by the American Society for Testing Materials. (Alberta is the only Province affected.)
[3] Data not available; estimate included in total.
[4] Estimate.
[5] In addition, the following quantities (metric tons) of asphaltite were produced and used as solid fuels: 1942, 56,387; 1943, 105,625; 1944, 106,300; 1945, 135,300; 1946, 83,800; 1947, 80,900; 1948 and 1949, data not available.
[6] July to December, inclusive.
[7] Data represent Trianon Hungary subsequent to October 1944.
[8] January to October, inclusive.
[9] Includes that part of Germany which is under Polish administration (east of the Oder and Neisse Rivers).
[10] Includes open-cast coal as follows, in thousands of tons: 1942, 1,332; 1943, 4,498; 1944, 8,787; 1945, 8,246; 1946, 8,965; 1947, 10,407; 1948, 11,916; 1949, 12,599.
[11] Production less than 1,000 tons.
[12] Estimated production of Croatia.
[13] January to June, inclusive.
[14] Excludes production of Ombilin mines in Sumatra.
[15] Fiscal year ended Mar. 20 of year following that stated.
[16] Fiscal year ended Mar. 31 of year following that stated.
[17] Included under India.
[18] Output from U. S. S. R. in Asia included with U. S. S. R. in Europe.
[19] Planned production.
[20] Including British Cameroons.
[21] Local sales and exports.
[22] January to September, inclusive.

Coal—Pennsylvania Anthracite

By J. A. Corgan and Marian I. Cooke

GENERAL SUMMARY

BECAUSE anthracite is primarily a space-heating fuel, the over-all annual consumption is affected directly by the intensity of the weather. Abnormally warm weather was one of the most important contributing factors in the sharp decline in the 1949 production of Pennsylvania anthracite to 42,701,724 net tons, a 25-percent decrease from 1948. Other important factors contributing to the drop in output were competition from other fuels, especially fuel oil and natural gas, and loss in foreign markets. With increased output of coal in Europe, those countries were in a better position to supply their own fuel needs, and Canada's requirements dropped commensurately with the extremely warm weather of the 1949 winter months.

The various types of mining contributed virtually the same proportions in 1949 as in 1948. Output from deep mines accounted for 63 percent of the 1949 production; strip pits, 24 percent; and culm banks, 11 percent. Dredging operations, which normally represent only a small part of the over-all annual output of anthracite, supplied 2 percent of the total output in 1949. Although the average number of men employed dropped to 75,377, a slight decline from 1948, the output per man per day, which averaged 2.81 tons in 1948, increased to 2.87 tons in 1949. The mines worked an average of 195 days compared with 265 days in 1948.

The New England and Middle Atlantic States, Maryland, Delaware, and the District of Columbia received 87 percent of the total anthracite shipments in 1949. Other States received 3 percent, and shipments to Canada and other foreign countries totaled 10 percent.

The mine workers received substantial wage increases and other benefits under a new wage contract between the anthracite producers and the United Mine Workers of America which became effective March 16, 1950; the contract will terminate June 30, 1952.

Statistical Trends—Tables 1 and 2 present pertinent statistical data on the Pennsylvania anthracite industry.

Anthracite Committee.—The Anthracite Committee continued its regular activities pertaining to the collection of data on employment, production, and requirements of anthracite and in addition kept the industry informed regarding "bootleg" mining activities. The committee is the only agency having complete and accurate statistics concerning the so-called bootleg mining industry, which in 1949 produced 1,257,218 net tons of anthracite. The committee continued its work regarding improvement in the quality of anthracite shipped from the mines. The Anthracite Standards Law approved May 31, 1947, was amended by the act of May 18, 1949, Public Law 437; the amendments became effective on September 1, 1949. This law applies to the sizes of anthracite commonly known as Broken, Egg, Stove,

TABLE 1.—Salient statistics of Pennsylvania anthracite industry, 1945–49

	1945	1946	1947	1948	1949
Production:					
Loaded at mines for shipment:					
Breakers net tons	[1] 45,249,706	50,115,427	[1] 48,073,153	47,816,627	35,653,628
Washeries do	[1] 2,551,426	3,106,521	[1] 2,009,233	1,725,124	1,380,115
Dredges do	741,319	886,639	970,027	941,441	655,753
Sold to local trade and used by employees net tons	4,273,864	4,435,536	4,232,871	4,795,721	3,848,420
Used at collieries for power and heat net tons	2,117,594	1,962,750	1,904,725	1,861,035	1,163,808
Total production do	54,933,909	60,506,873	57,190,009	57,139,948	42,701,724
Value at breaker, washery, or dredge	$323,944,435	$413,417,070	$413,019,486	$467,051,800	$358,008,451
Average sales realization per net ton on breaker shipments:					
Domestic	$7.93	$9.21	$9.82	$11.05	$11.39
Steam	$3.56	$4.08	$4.32	$4.90	$5.05
Total all sizes	$6.26	$7.25	$7.65	$8.67	$8.90
Percent in total breaker shipments:					
Total domestic	61.8	61.8	60.4	61.3	60.6
Total steam	38.2	38.2	39.6	38.7	39.4
Producers' stocks [2] net tons	130,000	251,168	702,109	963,839	975,457
Exports [3] do	3,691,000	6,497,245	8,509,995	6,675,914	4,942,670
Imports [3] do	149	9,556	10,350	945	----------
Consumption (apparent) do	51,600,000	53,900,000	48,200,000	50,200,000	37,700,000
Average number of days worked	269	271	259	265	195
Average number of men employed	72,842	78,145	78,600	76,215	75,377
Output per man per day net tons	2.79	2.84	2.78	2.81	2.87
Output per man per year do	751	770	720	745	560
Quantity cut by machines do	1,210,171	1,232,828	1,209,983	1,016,757	557,599
Quantity mined by stripping do	10,056,325	12,858,930	12,603,545	13,352,874	10,376,808
Quantity loaded by machines underground net tons	13,927,955	15,619,162	16,054,011	15,742,368	11,858,088
Distribution:					
Total receipts in New England [4] net tons	5,081,000	5,643,076	4,737,946	4,862,834	3,445,543
Exports to Canada [3] do	3,393,000	4,513,637	4,470,034	4,931,918	3,580,568
Loaded into vessels at Lake Erie [5] net tons	1,234,000	1,112,996	936,040	1,125,050	611,888
Receipts at Duluth-Superior [6] do	766,000	639,900	446,605	538,992	271,854

[1] Small quantity of washery coal included with "Breakers."
[2] Anthracite Committee.
[3] U. S. Department of Commerce.
[4] Commonwealth of Massachusetts, Division on the Necessaries of Life; and Association of American Railroads.
[5] Ore and Coal Exchange, Cleveland, Ohio.
[6] U. S. Engineer, Duluth, Minn.

Chestnut, Pea, Buckwheat No. 1, and Buckwheat No. 2 (Rice) and fixes certain standards for these sizes, including the maximum amount of ash content and of undersize permitted or, as regards Broken, Egg, Stove, Chestnut, and Pea sizes, the maximum percentage of slate and bone. Anthracite that conforms to the standards fixed by the act is standard anthracite; that which does not conform is called substandard anthracite. On and after September 1, 1949, all anthracite of the sizes referred to above which is produced in Pennsylvania must be attested by the producer as either standard anthracite or substandard anthracite, whether shipped to a point within or without the State. Standard anthracite specifications approved and adopted by the Anthracite Committee are shown in table 3.

Anthracite Institute.—In 1949 the Anthracite Institute continued the large industry advertising and promotional campaign started in 1948, in order to sell the advantages of anthracite and anthracite-burning equipment to the public. Consumer advertisements were run in leading newspapers of the anthracite-marketing area; these were supplemented by magazine and trade periodical advertising. In addition, over-all industry advertising was augmented by several

TABLE 2.—Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1949

[All tonnage figures represent net tons]

	January	February	March	April	May	June	July	August	September	October	November	December	Total 1949	Change from 1948 (percent)	Total 1948
Production (including mine fuel, local sales, and dredge coal)	3,725,000	2,930,000	2,375,000	3,725,000	4,407,000	3,406,000	3,925,000	3,710,000	2,114,000	4,979,000	4,657,000	2,749,000	42,702,000	−25.3	57,140,000
Shipments (breakers and washeries only, all sizes):															
By rail [1]	2,889,862	2,235,829	1,876,945	3,104,266	3,760,937	3,069,768	3,055,582	3,127,286	2,133,628	3,829,248	3,646,935	2,502,070	35,232,356	−25.5	47,298,381
By truck [2]	679,061	553,579	466,330	479,955	555,043	437,161	292,331	374,380	358,731	605,332	632,146	654,075	6,088,124	−20.0	7,610,195
Carloadings [3]	56,759	44,843	38,846	60,819	72,169	57,154	62,853	61,285	39,594	76,601	70,160	47,443	688,526	−25.0	917,685
Distribution:															
Lake Erie loadings [4]				26,035	73,893	59,101	86,857	71,662	66,901	125,923	101,516		611,888	−45.6	1,125,050
Lake Ontario loadings [5]				17,591	30,865	24,880	14,648	19,864	17,662	17,249	25,795		168,554	−14.5	107,252
Receipts at Duluth-Superior [6]				8,164	21,824	27,741	23,623	17,554	30,432	70,164	72,352		271,854	−49.6	538,992
Upper Lake dock trade: [7]															
Receipts:															
Lake Superior	22			8,045	21,823	27,843	23,711	17,650	30,438	70,206	75,949	57	275,744	−51.9	573,072
Lake Michigan	4,201	2,918	1,800	21,161	52,776	23,454	36,870	55,367	43,392	40,859	50,957	518	334,273	−31.0	484,791
Deliveries (reloadings):															
Lake Superior	87,645	40,189	13,369	2,436	9,761	10,118	9,826	24,328	39,115	56,824	67,466	46,415	356,992	−29.7	508,003
Lake Michigan	32,988	34,233	29,552	13,512	28,643	32,656	25,120	40,906	44,176	39,129	31,862	29,589	382,316	−17.5	463,020
New England receipts:															
By tide [8]	9,289	2,609	1,537	9,100	15,825	10,246	14,206	13,079	10,120	10,244	9,470	3,939	109,754	−49.4	216,928
By rail [8]	287,801	176,445	155,167	247,891	326,070	322,437	291,093	301,415	230,270	321,947	401,717	273,536	3,335,789	−28.2	4,645,906
Exports [9]	305,452	337,950	300,652	424,145	616,931	609,843	358,119	382,382	399,256	509,657	421,005	277,278	4,942,670	−26.0	6,675,914
Imports [9]															945
Industrial consumption and stocks by:															
Railroads (class 1 only): [4]															
Consumption	90,644	76,132	76,973	57,000	50,375	44,100	41,823	42,846	45,630	64,077	70,920	76,198	735,718	−18.7	905,063
Stocks	92,255	80,044	58,473	62,317	61,821	64,847	61,176	62,726	64,968	70,378	68,502	66,388	66,388	−31.4	96,792
Electric power utilities: [10]															
Consumption	318,675	263,279	281,755	252,790	259,128	257,600	258,178	302,130	272,352	290,986	292,217	304,758	3,353,857	−15.4	3,965,965
Stocks	2,548,257	2,484,773	2,375,998	2,459,628	2,634,252	2,744,799	2,820,706	3,992,748	4,020,784	4,179,321	2,298,783	4,259,533	4,259,533	+71.5	2,483,372
Stocks on Upper Lake docks: [7]															
Lake Superior	160,442	120,252	105,671	111,064	122,127	139,852	154,237	147,556	137,401	150,875	158,967	112,652	112,652	−24.2	108,065
Lake Michigan	153,222	121,907	94,155	102,063	126,193	116,991	128,741	143,202	142,418	144,149	163,244	134,173	134,173	−26.3	181,959
Producers' stocks [11]	927,859	836,779	442,117	573,429	584,470	449,837	661,295	879,136	600,620	724,180	1,138,350	975,457	975,457	+1.2	963,839
Sales of mechanical stokers: [9]															
Class 1 (capacity under 61 lb. of coal per hour)	301	285	326	249	259	569	376	510	723	519	319	168	4,604	−51.7	9,524
Class 2 (capacity 61 to 100 lb. of coal per hour)	34	20	14	12	10	47	37	61	82	53	48	60	478	−37.2	761

See footnotes at end of table.

TABLE 2.—Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1949—Continued

[All tonnage figures represent net tons]

	January	February	March	April	May	June	July	August	September	October	November	December	Total 1949	Change from 1948 (percent)	Total 1948
Wholesale price indices (1926=100): [12]															
On tracks, destination:															
Chestnut	133.7	134.1	134.1	131.3	130.2	130.6	131.8	132.3	134.7	135.2	135.4	135.4	133.2	+5.0	126.9
Pea	153.6	153.8	155.5	150.1	148.8	149.2	150.3	150.8	154.3	154.9	154.2	154.9	152.4	+5.3	144.7
Labor conditions: [12]															
Average weekly earnings	$67.39	$47.97	$46.15	$56.82	$63.63	$45.28	$66.08	$42.80	$59.24	$75.81	$67.94	$42.22	$56.78	−14.3	$66.27
Average hourly earnings	$1.872	$1.838	$1.846	$1.857	$1.866	$1.935	$1.888	$1.829	$1.863	$1.934	$1.903	$1.919	$1.879	+3.8	$1.811
Average hours worked per week	36.0	26.1	25.0	30.6	34.1	23.4	35.0	23.4	31.8	39.2	35.7	22.0	30.2	−17.5	36.6

[1] Furnished by Anthracite Institute.
[2] Pennsylvania Department of Mines.
[3] Association of American Railroads.
[4] Ore and Coal Exchange, Cleveland, Ohio.
[5] Buffalo Branch, Ore and Coal Exchange, Cleveland, Ohio.
[6] U. S. Engineer Office, Duluth, Minn.
[7] Includes all commercial docks on Lake Superior and west shore of Lake Michigan as far south as Kenosha. Based on data courteously supplied by Maher Coal Bureau and direct reports to the Bureau of Mines.
[8] Furnished by Commonwealth of Massachusetts, Division on the Necessaries of Life.
[9] U. S. Department of Commerce.
[10] Federal Power Commission.
[11] Anthracite Committee. Represents coal in storage nearest available date to the end of the month.
[12] Bureau of Labor Statistics.

TABLE 3.—Standard anthracite specifications approved and adopted by the Anthracite Committee effective July 28, 1947

Percent

	Round test mesh, inches	Oversize, maximum	Undersize		Maximum, impurities [1]		
			Maximum	Minimum	Slate	Bone or ash [2]	
Broken	Through 4 3/8				1½	2	11
	Over 3¼ to 3		15	7½			
Egg	Through 3¼ to 3	5			1½	2	11
	Over 2 7/16		15	7½			
Stove	Through 2 7/16	7½			2	3	11
	Over 1 5/8		15	7½			
Chestnut	Through 1 5/8	7½			3	4	11
	Over 13/16		15	7½			
Pea	Through 13/16	10			4	5	12
	Over 9/16		15	7½			
Buckwheat No. 1	Through 9/16	10					13
	Over 5/16		15	7½			
Buckwheat No. 2 (Rice)	Through 5/16	10					13
	Over 3/16		17	7½			
Buckwheat No. 3 (Barley)	Through 3/16	10					15
	Over 3/32		20	10			
Buckwheat No. 4	Through 3/32	20					15
	Over 3/64		30	10			
Buckwheat No. 5	Through 3/64	30	No limit				16

[1] When slate content in the sizes from Broken to Chestnut, inclusive, is less than above standards, bone content may be increased by 1½ times the decrease in the slate content under the allowable limits, but slate content specified above shall not be exceeded in any event.

A tolerance of 1 percent is allowed on the maximum percentage of undersize and the maximum percentage of ash content.

The maximum percentage of undersize is applicable only to anthracite as it is produced at the preparation plant.

"Slate" is defined as any material which has less than 40 percent fixed carbon.

"Bone" is defined as any material which has 40 percent or more, but less than 75 percent fixed carbon.

[2] Ash determinations are on a dry basis.

outstanding campaigns of individual producing companies. Funds approved by the anthracite industry for use by the institute in 1950 call for the largest advertising and promotional campaign in anthracite's history. In 1949 the institute conducted anthracite stoker schools (using the audiovisual method of training) in 27 cities in the United States and 12 cities in Canada. The dealer training program, relating to the use of thermostats, stokers, heater conditioning, etc., was enlarged greatly in 1949, and further expansion will take place in 1950. The institute carried on extensive research into various phases of the utilization of anthracite. This research is discussed in some detail in this chapter under Research and Technology.

Labor Relations.—The Pennsylvania anthracite mines were closed for various reasons on several occasions in 1949. The United Mine Workers of America authorized a memorial period, March 14–28, in which the workers remained away from the mines; the union also called for a stabilizing period, June 13–20, and work ceased at the mines; another suspension occurred during the latter part of September over matters pertaining to the welfare fund; and effective Monday, December 5, and continuing to March 4, 1950, the United Mine Workers of America decided to work only 3 days a week. A new wage agreement was reached by the anthracite operators and the United Mine Workers on March 9, 1950, to supersede the amended contract of July 3, 1948. Substantial wage increases were received by the mine workers under the agreement, and the royalty on each ton of anthracite produced

was increased from 20 to 30 cents per ton. The contract called for the miners' 1950 vacation period to begin July 1 and end July 11; the vacation payment of $100 was continued. The agreement was effective as of March 16, 1950, and terminates June 30, 1952, provided, however, that either party may terminate the agreement on or after April 1, 1951, by giving at least 30 days' written notice to the other party of such desired earlier termination date.

Research and Technology.—In 1949 the Anthracite Flood Prevention Section of the Bureau of Mines continued to cooperate with the anthracite producers and the Commonwealth of Pennsylvania in obtaining information relating to the underground mine-water problem in the Pennsylvania anthracite region. Data of a technical nature have been evaluated, plans are being prepared to aid in solving the mine-water problem, and a number of reports covering various phases of this subject were prepared for publication. Bureau of Mines Report of Investigations 4656,[1] released in March 1950, gives data concerning the design and performance of deep-well and shaft pumps and their application to anthracite flood-prevention projects that can favorably use pumps of these types. The report includes a description of deep-well and shaft pumps in the anthracite area, data concerning their dependability, estimates of installation costs, and the general acceptance of the pumps by the anthracite producers. Bureau of Mines Bulletin 491 [2] presents a detailed report on the water problem of the Eastern Middle field. The inundated reserves in this field were studied with special reference to various methods by which the water could be removed economically from each of the pools in the field. The anthracite reserves have been depleted greatly in this area and by removing water in certain pools where it can be done economically, the life of the reserves will be extended and the future of the industry in this field brightened. Drainage tunnels are an important factor in removing water from the underground workings, and the report discusses this method of unwatering mines in some detail. Bureau of Mines Report of Investigations 4700 [3] furnishes detailed data on pumping practices which will be indispensable in solving the anthracite mine-water problem. The report includes a vicinity map showing the four anthracite fields; a description of horizontal centrifugal pumps, deep-well and shaft pumps, and plunger pumps; pictures of various mine-pumping-plant installations in the anthracite region, a map showing colliery-pumping stations and drainage tunnel discharge portals; and other technical data, including charts and graphs that concern the mine-water problem.

Virtual completion during the latter part of 1949 of the Bureau of Mines new research laboratory at Schuylkill Haven, Pa., is expected to speed the Bureau's research on mining, preparation, and utilization of anthracite. The Bureau is cooperating with anthracite producers in various mechanical mining studies whereby it is believed that the underground output per man per day may be increased. Considerable work has been done with air-powered German light-weight shearing

[1] Lesser, William H., Deep-Well Pumps and Shaft Pumps in Anthracite Mines of Pennsylvania: Bureau of Mines Rept. of Investigations 4656, 1950, 52 pp.

[2] Ash, S. H., Kynor, H. D., Fatzinger, R. W., Davis, B. S., and Gilbert, J. C., Inundated Anthracite Reserves; Eastern Middle field of Pennsylvania: Bureau of Mines Bull. 491, 1950, 28 pp.

[3] Ash, S. H., Eaton, W. L., Gilbert, J. C., James, H. N., Jenkins, H. E., Kennedy, D. O., Kynor, H. D., Link, H. B., and Romischer, W. M., Pumping Data of the Anthracite Region of Pennsylvania: Bureau of Mines Rept. of Investigations 4700, 1950, 261 pp.

machines for use in both flat and pitching beds. Testing and experimental work is underway with a packing machine of German origin that has had widespread usage for many years on the Continent and in England. Experimental work was conducted in the design of a fully mechanized timbering method, whereby safety for face workers might be improved and heavy labor employed in conventional methods reduced.

The Anthracite Institute, at its laboratory in Wilkes-Barre, Pa., conducted extensive work on new and improved methods of burning anthracite in automatic coal-burning equipment. Research was continued on anthracite pellet production and the use of anthracite in fluid gas producers, and in curing tobacco.

The joint technical committee of the anthracite, bituminous, and coke industries continued its research on matters of interest to the three industries and stressed work on new ash-removal methods.

Research on anthracite conducted at the Pennsylvania State College over the past several years has covered a wide range of subjects, particular emphasis being placed on the upgrading and utilization of fine sizes of anthracite, the recovery and cleaning of fines by various processes, the use of anthracite as cupola fuel, the blending of anthracite fines with bituminous coal in producing coke, and the combustion and gasification of anthracite with regard to the flow of gases through coal beds of various sizes of anthracite.

The Eighth Annual Anthracite Conference met at Lehigh University, Bethlehem, Pa., in May 1950. Many excellent papers pertaining to anthracite research were presented.

Imports and Exports.—Exports of anthracite to foreign countries during 1949 were greater than in any year since 1923 with the exception of shipments during the postwar years 1946–48. The decline in exports in 1949 to 4,942,670 net tons from the total of 6,675,914 tons in 1948 was due largely to the sharp decrease in shipments to Canada. The abnormally warm weather in Canada during part of 1948 and the winter months of 1949 bore directly on the consumption of anthracite in that country and is believed to be the principal reason for the 27-percent decline in exports from the United States. One of the principal reasons for our greatly increased exports to Canada in recent years has been the inability of Great Britain to export anthracite to the Dominion in amounts approaching prewar levels. In 1949 Canada received 365,842 net tons of anthracite from Great Britain, compared with average annual shipments of about 1,200,000 tons before World War II. The decline in our export shipments to European countries—1,243,214 tons in 1949, compared with 1,692,967 in 1948 and 3,918,463 in 1947—may be attributed largely to increased output of coal in Great Britain, Poland, Germany, and France which enabled those countries in some instances to export coal to other European countries. France received 85 percent of the shipments to Europe in 1949, virtually all of which was Buckwheat No. 3 and smaller sizes of anthracite. Indications are that 1950 exports of anthracite to countries other than Canada will be negligible.

The total quantity of anthracite imported into the United States has been insignificant in recent years and constituted a very small part of our total consumption. There were no imports in 1949. Details of imports for 1947–48 are given in table 39.

SOURCES AND ACKNOWLEDGMENTS

Annual statistics of the Pennsylvania anthracite-mining industry are prepared from a canvass, by mail, of all known anthracite operations; about 99 percent of the tonnage is reported directly by producers, and the remaining 1 percent is estimated on collateral evidence. The data on individual operations furnished by the producers are voluntary and confidential, as is customary in the statistical services of the Bureau of Mines.

The standard form of report, as developed by the Bureau and its predecessor in mineral statistics, the Geological Survey, provides for data on production, shipments, mine realization of products, mechanization, plant and equipment, and employment.

In assembling available detailed information, free use has been made of the pertinent figures prepared by the Pennsylvania Department of Mines, the Anthracite Institute, the Anthracite Committee, and the Association of American Railroads, to all of whom thanks are extended for their cordial and continued cooperation. Thanks are due especially to the producers for reporting so promptly and, in general, so fully upon their operations in 1949, when the year as a whole was so critical for the industry.

PRODUCTION

The output of Pennsylvania anthracite in 1949 totaled 42,701,724 net tons, a sharp decline from the production of 57,139,948 tons in 1948. The decrease can be attributed to the impact on anthracite of competitive fuels, especially fuel oil and natural gas, and lessened consumption due to abnormally warm weather in the winter months of 1949. These statistics include deep-mined and strip-pit output, coal recovered from culm banks, anthracite purchased by the industry from "bootleggers," and river or creek coal recovered from the streams draining the anthracite fields. Also included is a small tonnage of semianthracite (20,090 tons in 1949) produced in Sullivan County.

In recent years conditions have favored development of numerous small mines operating on lease or subcontract and producing run-of-mine coal, which is sold to larger companies for preparation at a breaker. At the same time, an increasing transfer of coal from one operation to another has developed; and some of the companies have built central breakers to which coal from numerous mines is shipped, by rail or truck, for preparation. These tendencies have increased the complexity of the task of collecting and compiling statistics of the industry; but great care has been exercised to avoid double counting of tonnages produced by one operator and prepared for market by another. The figures herein represent the net quantity of merchantable coal plus the fuel used by the collieries themselves.

Prior to the early 1930's anthracite was produced only by concerns that owned or leased the coal lands; during the depression, however, unemployed miners began to mine anthracite in the Lehigh and Schuylkill regions from land of the operating companies and transported the coal to market by truck. Before 1941 this coal, generally

referred to as "bootleg" coal, was not included in the production statistics of the Pennsylvania anthracite industry compiled by the Bureau of Mines. In 1941, however, the anthracite industry began to purchase run-of-mine coal from the so-called bootleggers for preparation and shipment to market. In 1949 these purchases totaled 442,541 net tons. As it is impractical to segregate the purchased anthracite from the output of the industry proper, it is therefore included in the various production tables in the Minerals Yearbook chapters on Pennsylvania anthracite for 1941–49. To compute the output per man per day for the anthracite industry, it was necessary to deduct these purchases from the total tonnage shipped by the recognized industry, because adequate data on man-days required to produce the "bootleg" coal are not available. Details on this procedure are discussed in the Employment section of this chapter. See tables 4 to 9 for production and shipments by fields, regions, and counties. Tables 10 and 11 show percentages, by regions, of various sizes in relation to total breaker product.

TABLE 4.—Pennsylvania anthracite produced, 1945–49 by fields, in net tons

[The figures of breaker product include a certain quantity of culm-bank coal, which amounted to 3,013,712 tons in 1949]

Field	1945	1946	1947	1948	1949
Eastern Middle:					
Breakers	[1] 5,005,245	5,057,619	4,270,240	4,467,628	3,379,672
Washeries	[1] 342,116	282,481	315,014	298,601	238,532
Total Eastern Middle	5,347,361	5,340,100	4,585,254	4,766,229	3,618,204
Western Middle:					
Breakers	11,540,524	13,040,147	12,147,528	12,405,178	9,636,944
Washeries	130,789	530,246	591,652	240,157	135,670
Dredges	308,976	362,423	411,804	311,183	246,906
Total Western Middle	11,980,289	13,932,816	13,150,984	12,956,518	10,019,520
Southern:					
Breakers	10,916,769	11,817,427	11,643,971	11,622,538	8,776,671
Washeries	1,373,578	1,386,125	237,131	496,194	484,595
Dredges	896,250	761,131	796,174	664,350	603,217
Total Southern	13,186,597	13,964,683	12,677,276	12,783,082	9,864,483
Northern:					
Breakers	23,503,306	26,227,918	25,831,439	25,839,648	18,579,965
Washeries	[1] 735,041	925,427	890,368	719,676	584,463
Dredges	----------	8,840	11,728	12,471	14,990
Total Northern	24,238,347	27,162,185	26,733,535	26,571,795	19,179,418
Total, excluding Sullivan County:					
Breakers	50,965,844	56,143,111	53,893,178	54,334,992	40,373,252
Washeries	[1] 2,581,524	3,124,279	2,034,165	1,754,628	1,443,260
Dredges	1,205,226	1,132,394	1,219,706	988,004	865,122
Total, excluding Sullivan County	54,752,594	60,399,784	57,147,049	57,077,624	42,681,634
Sullivan County:					
Breakers	149,505	85,402	[1] 42,960	62,324	20,090
Washeries	31,810	21,687	([1])	----------	----------
Total Sullivan County	181,315	107,089	42,960	62,324	20,090
Grand total	54,933,909	60,506,873	57,190,009	57,139,948	42,701,724

[1] Small quantity of washery coal included with breaker.

TABLE 5.—Pennsylvania anthracite shipped, sold locally, and used as colliery fuel in 1949, by regions

Region	Shipments		Local sales		Colliery fuel		Total	
	Net tons	Value [1]	Net tons	Value	Net tons	Value	Net tons	Value [1]
Lehigh:								
Breakers	6,490,186	$54,943,098	326,536	$3,213,845	163,504	$1,032,198	6,980,226	$59,189,141
Washeries	271,772	857,682	3,771	31,785	170	863	275,713	890,330
Dredges	22,131	39,256					22,131	39,256
Total Lehigh	6,784,089	55,840,036	330,307	3,245,630	163,674	1,033,061	7,278,070	60,118,727
Schuylkill:								
Breakers	13,750,139	111,719,031	860,277	6,029,403	202,655	485,167	14,813,071	118,233,601
Washeries	575,549	2,310,581	6,992	27,014	543	3,096	583,084	2,340,691
Dredges	633,622	1,641,702	193,769	412,475	600	1,663	827,991	2,055,840
Total Schuylkill	14,959,310	115,671,314	1,061,038	6,468,892	203,798	489,926	16,224,146	122,630,132
Wyoming:								
Breakers	15,401,360	150,396,756	2,382,259	20,244,798	796,336	2,350,525	18,579,955	172,992,079
Washeries	532,794	1,840,567	51,669	201,642			584,463	2,042,209
Dredges			15,000	36,000			15,000	36,000
Total Wyoming	15,934,154	152,237,323	2,448,928	20,482,440	796,336	2,350,525	19,179,418	175,070,288
Total, excluding Sullivan County:								
Breakers	35,641,685	317,058,885	3,569,072	29,488,046	1,162,495	3,867,890	40,373,252	350,414,821
Washeries	1,380,115	5,008,830	62,432	260,441	713	3,959	1,443,260	5,273,230
Dredges	655,753	1,680,958	208,769	448,475	600	1,663	865,122	2,131,096
Total	37,677,553	323,748,673	3,840,273	30,196,962	1,163,808	3,873,512	42,681,634	357,819,147
Sullivan County: [2]								
Breakers	11,943	110,545	8,147	78,759			20,090	189,304
Grand total:								
1949	37,689,496	323,859,218	3,848,420	30,275,721	1,163,808	3,873,512	42,701,724	358,008,451
1948	50,483,192	423,601,116	4,795,721	37,851,673	1,861,035	5,599,011	57,139,948	467,051,800
Change, 1949—percent	−25.3	−23.5	−19.8	−20.0	−37.5	−30.8	−25.3	−23.3

[1] Value given for shipments is value at which coal left possession of producing company and does not include margins of separately incorporated sales companies.

[2] For purposes of historical comparison and statistical convenience, the mines of Sullivan County are grouped with the Pennsylvania anthracite region, although the product is classified as semianthracite according to the American Society for Testing Materials Tentative Standard.

TABLE 6.—Pennsylvania anthracite produced in 1949, classified as fresh-mined, culm bank, and river coal, and as breaker, washery, and dredge product, by regions, in net tons

Region and type of plant	From mines			From culm banks	From river dredging	Total
	Underground		Strip pits			
	Mechanically loaded	Hand loaded				
Lehigh:						
Breakers	396,677	3,732,584	2,431,915	419,050		6,980,226
Washeries				275,713		275,713
Dredges					22,131	22,131
Total Lehigh	396,677	3,732,584	2,431,915	694,763	22,131	7,278,070
Schuylkill:						
Breakers	1,417,309	5,511,414	5,661,473	2,222,875		14,813,071
Washeries			27,828	555,256		583,084
Dredges					827,991	827,991
Total Schuylkill	1,417,309	5,511,414	5,689,301	2,778,131	827,991	16,224,146
Wyoming:						
Breakers	10,044,102	5,908,474	2,255,592	371,787		18,579,955
Washeries				584,463		584,463
Dredges					15,000	15,000
Total Wyoming	10,044,102	5,908,474	2,255,592	956,250	15,000	19,179,418
Total, excluding Sullivan County:						
Breakers	11,858,088	15,152,472	10,348,980	3,013,712		40,373,252
Washeries			27,828	1,415,432		1,443,260
Dredges					865,122	865,122
Total	11,858,088	15,152,472	10,376,808	4,429,144	865,122	42,681,634
Sullivan County: Breakers		20,090				20,090
Grand total	11,858,088	15,172,562	10,376,808	4,429,144	865,122	42,701,724

TABLE 7.—Pennsylvania anthracite produced in 1949, classified as fresh-mined, culm bank, and river coal, and as breaker, washery, and dredge product, by fields, in net tons

Field and type of plant	From mines			From culm banks	From river dredging	Total
	Underground		Strip pits			
	Mechanically loaded	Hand loaded				
Eastern Middle:						
Breakers	396, 677	1, 410, 025	1, 379, 405	193, 565		3, 379, 672
Washeries				238, 532		238, 532
Total Eastern Middle	396, 677	1, 410, 025	1, 379, 405	432, 097		3, 618, 204
Western Middle:						
Breakers	920, 183	4, 018, 433	3, 331, 563	1, 366, 775		9, 636, 954
Washeries			27, 828	107, 842		135, 670
Dredges					246, 905	246, 905
Total Western Middle	920, 183	4, 018, 433	3, 359, 391	1, 474, 617	246, 905	10, 019, 529
Southern:						
Breakers	497, 126	3, 815, 540	3, 382, 420	1, 081, 585		8, 776, 671
Washeries				484, 595		484, 595
Dredges					603, 217	603, 217
Total Southern	497, 126	3, 815, 540	3, 382, 420	1, 566, 180	603, 217	9, 864, 483
Northern:						
Breakers	10, 044, 102	5, 908, 474	2, 255, 592	371, 787		18, 579, 955
Washeries				584, 463		584, 463
Dredges					15, 000	15, 000
Total Northern	10, 044, 102	5, 908, 474	2, 255, 592	956, 250	15, 000	19, 179, 418
Total, excluding Sullivan County:						
Breakers	11, 858, 088	15, 152, 472	10, 348, 980	3, 013, 712		40, 373, 252
Washeries			27, 828	1, 415, 432		1, 443, 260
Dredges					865, 122	865, 122
Total	11, 858, 088	15, 152, 472	10, 376, 808	4, 429, 144	865, 122	42, 681, 634
Sullivan County: Breakers		20, 090				20, 090
Grand total	11, 858, 088	15, 172, 562	10, 376, 808	4, 429, 144	865, 122	42, 701, 724

TABLE 8.—Pennsylvania anthracite shipped in 1949, by regions and sizes

Size	Breaker shipments [1]								
	Lehigh region			Schuylkill region			Wyoming region		
	Outside region	Local sales	Total	Outside region	Local sales	Total	Outside region	Local sales	Total
NET TONS									
Lump [2] and Broken	25,582	127	25,709	37,329	2,176	39,505	24,509	16,704	41,213
Egg	188,498	317	188,815	426,082	1,643	427,725	526,968	3,325	530,293
Stove	1,335,215	7,127	1,342,342	2,411,685	49,966	2,461,651	4,524,641	94,099	4,618,740
Chestnut	1,483,421	87,417	1,570,838	3,070,631	158,291	3,228,922	4,884,760	419,517	5,304,277
Pea	501,128	126,499	627,627	1,138,427	161,809	1,300,236	1,028,596	713,501	1,742,097
Total domestic	3,533,844	221,487	3,755,331	7,084,154	373,885	7,458,039	10,989,474	1,247,146	12,236,620
Buckwheat No. 1	846,965	47,526	894,491	1,950,161	82,547	2,032,708	2,068,598	354,128	2,422,726
Buckwheat No. 2 (Rice)	527,746	46,983	574,729	1,222,652	71,220	1,293,872	1,070,649	223,749	1,294,398
Buckwheat No. 3 (Barley)	628,679	10,534	639,213	1,729,378	60,115	1,789,493	924,559	489,995	1,414,554
Buckwheat No. 4	513,268	4	513,272	865,496	261,655	1,127,151	177,117	33,265	210,382
Other (including silt)	439,684	2	439,686	898,298	10,855	909,153	170,963	33,976	204,939
Total steam	2,956,342	105,049	3,061,391	6,665,985	486,392	7,152,377	4,411,886	1,135,113	5,546,999
Grand total	6,490,186	326,536	6,816,722	13,750,139	860,277	14,610,416	15,401,360	2,382,259	17,783,619
VALUE									
Lump [2] and Broken	$306,451	$1,502	$307,953	$431,373	$25,502	$456,875	$285,876	$185,789	$471,665
Egg	2,226,364	4,026	2,230,390	4,931,257	19,246	4,950,503	6,080,074	40,653	6,120,727
Stove	15,756,916	87,490	15,844,406	27,879,067	580,208	28,459,275	52,534,568	1,154,845	53,689,413
Chestnut	17,525,349	1,091,855	18,617,204	35,691,451	1,874,034	37,565,485	56,666,062	5,160,287	61,826,349
Pea	4,943,540	1,328,664	6,272,204	10,880,109	1,543,739	12,423,848	9,978,920	7,339,933	17,318,853
Total domestic	40,758,620	2,513,537	43,272,157	79,813,257	4,042,729	83,855,986	125,545,500	13,881,507	139,427,007
Buckwheat No. 1	5,623,684	347,466	5,971,150	12,548,365	543,898	13,092,263	13,714,404	2,524,100	16,238,504
Buckwheat No. 2 (Rice)	2,934,608	301,113	3,235,721	6,673,413	378,784	7,052,197	6,031,634	1,353,398	7,385,032
Buckwheat No. 3 (Barley)	2,741,490	51,705	2,793,195	7,371,978	261,069	7,633,047	4,036,789	2,321,989	6,358,778
Buckwheat No. 4	1,657,697	19	1,657,716	2,693,505	769,276	3,462,781	588,818	97,412	686,230
Other (including silt)	1,226,999	5	1,227,004	2,618,513	33,647	2,652,160	479,611	66,302	546,003
Total steam	14,184,478	700,308	14,884,786	31,905,774	1,986,674	33,892,448	24,851,256	6,363,201	31,214,547
Grand total	54,943,098	3,213,845	58,156,943	111,719,031	6,029,403	117,748,434	150,396,756	20,244,798	170,641,554

See footnotes at end of table.

TABLE 8.—Pennsylvania anthracite shipped in 1949, by regions and sizes—Continued

Size	Breaker shipments [1]								
	Lehigh region			Schuylkill region			Wyoming region		
	Outside region	Local sales	Total	Outside region	Local sales	Total	Outside region	Local sales	Total
AVERAGE VALUE PER TON									
Lump [2] and Broken	$11.98	$11.83	$11.98	$11.56	$11.72	$11.56	$11.66	$11.12	$11.44
Egg	11.81	12.70	11.81	11.57	11.71	11.57	11.54	12.23	11.54
Stove	11.80	12.28	11.80	11.56	11.61	11.56	11.61	12.27	11.62
Chestnut	11.81	12.49	11.85	11.62	11.84	11.63	11.60	12.30	11.66
Pea	9.86	10.50	9.99	9.56	9.54	9.56	9.70	10.29	9.94
Total domestic	11.53	11.35	11.52	11.27	10.81	11.24	11.42	11.13	11.39
Buckwheat No. 1	6.64	7.31	6.68	6.43	6.59	6.44	6.63	7.13	6.70
Buckwheat No. 2 (Rice)	5.56	6.41	5.63	5.46	5.32	5.45	5.63	6.05	5.71
Buckwheat No. 3 (Barley)	4.36	4.91	4.37	4.26	4.34	4.27	4.37	4.74	4.50
Buckwheat No. 4	3.23	4.75	3.23	3.11	2.94	3.07	3.32	2.93	3.26
Other (including silt)	2.79	2.50	2.79	2.91	3.10	2.92	2.81	1.95	2.66
Total steam	4.80	6.67	4.86	4.79	4.08	4.74	5.63	5.61	5.63
Grand total	8.47	9.84	8.53	8.12	7.01	8.06	9.77	8.50	9.60

See footnotes at end of table.

Size	Breaker shipments [1]—Continued								
	Sullivan County			Total					
				Excluding Sullivan County			Including Sullivan County		
	Outside region	Local sales	Total	Outside region	Local sales	Total	Outside region	Local sales	Total
NET TONS									
Lump[2] and Broken				87,420	19,007	106,427	87,420	19,007	106,427
Egg				1,141,548	5,285	1,146,833	1,141,548	5,285	1,146,833
Stove	3,823	2,688	6,511	8,271,541	151,192	8,422,733	8,275,364	153,880	8,429,244
Chestnut	4,538	3,422	7,960	9,438,812	665,225	10,104,037	9,443,350	668,647	10,111,997
Pea	1,194	489	1,683	2,668,151	1,001,809	3,669,960	2,669,345	1,002,298	3,671,643
Total domestic	9,555	6,599	16,154	21,607,472	1,842,518	23,449,990	21,617,027	1,849,117	23,466,144
Buckwheat No. 1	245	490	735	4,865,724	484,201	5,349,925	4,865,969	484,691	5,350,660
Buckwheat No. 2 (Rice)				2,821,047	341,952	3,162,999	2,821,047	341,952	3,162,999
Buckwheat No. 3 (Barley)				3,282,616	560,644	3,843,260	3,282,616	560,644	3,843,260
Buckwheat No. 4				1,555,881	294,924	1,850,805	1,555,881	294,924	1,850,805
Other (including silt)	2,143	1,058	3,201	1,508,945	44,833	1,553,778	1,511,088	45,891	1,556,979
Total steam	2,388	1,548	3,936	14,034,213	1,726,554	15,760,767	14,036,601	1,728,102	15,764,703
Grand total	11,943	8,147	20,090	35,641,685	3,569,072	39,210,757	35,653,628	3,577,219	39,230,847
VALUE									
Lump[2] and Broken				$1,023,700	$212,793	$1,236,493	$1,023,700	$212,793	$1,236,493
Egg				13,237,695	63,925	13,301,620	13,237,695	63,925	13,301,620
Stove	$41,899	$29,574	$71,473	96,170,551	1,822,543	97,993,094	96,212,450	1,852,117	98,064,567
Chestnut	49,829	37,635	87,464	109,882,862	8,126,176	118,009,038	109,932,691	8,163,811	118,096,502
Pea	10,606	4,645	15,251	25,802,569	10,212,336	36,014,905	25,813,175	10,216,981	36,030,156
Total domestic	102,334	71,854	174,188	246,117,377	20,437,773	266,555,150	246,219,711	20,509,627	266,729,338
Buckwheat No. 1	1,225	3,233	4,458	31,886,453	3,415,464	35,301,917	31,887,678	3,418,697	35,306,375
Buckwheat No. 2 (Rice)				15,639,655	2,033,295	17,672,950	15,639,655	2,033,295	17,672,950
Buckwheat No. 3 (Barley)				14,150,257	2,634,763	16,785,020	14,150,257	2,684,763	16,785,020
Buckwheat No. 4				4,940,020	866,707	5,806,727	4,940,020	866,707	5,806,727
Other (including silt)	6,986	3,672	10,658	4,325,123	100,044	4,425,167	4,332,109	103,716	4,435,825
Total steam	8,211	6,905	15,116	70,941,508	9,050,273	79,991,781	70,949,719	9,057,178	80,006,897
Grand total	110,545	78,759	189,304	317,058,885	29,488,046	346,546,931	317,169,430	29,566,805	346,736,235

See footnotes at end of table.

TABLE 8.—Pennsylvania anthracite shipped in 1949, by regions and sizes—Continued

Size	Breaker shipments [1]—Continued								
	Sullivan County			Total					
				Excluding Sullivan County			Including Sullivan County		
	Outside region	Local sales	Total	Outside region	Local sales	Total	Outside region	Local sales	Total
AVERAGE VALUE PER TON									
Lump [2] and Broken				$11.71	$11.20	$11.62	$11.71	$11.20	$11.62
Egg				11.60	12.10	11.60	11.60	12.10	11.60
Stove	$10.96	$11.00	$10.98	11.63	12.05	11.63	11.63	12.04	11.63
Chestnut	10.98	11.00	10.99	11.64	12.22	11.68	11.64	12.21	11.68
Pea	8.88	9.50	9.06	9.67	10.19	9.81	9.67	10.19	9.81
Total domestic	10.71	10.89	10.78	11.39	11.09	11.37	11.39	11.09	11.37
Buckwheat No. 1	5.00	6.60	6.07	6.55	7.05	6.60	6.55	7.05	6.60
Buckwheat No. 2 (Rice)				5.54	5.95	5.59	5.54	5.95	5.59
Buckwheat No. 3 (Barley)				4.31	4.70	4.37	4.31	4.70	4.37
Buckwheat No. 4				3.18	2.94	3.14	3.18	2.94	3.14
Other (including silt)	3.26	3.47	3.33	2.87	2.23	2.85	2.87	2.26	2.85
Total steam	3.44	4.46	3.84	5.05	5.24	5.08	5.05	5.24	5.08
Grand total	9.26	9.67	9.42	8.90	8.26	8.84	8.90	8.27	8.84

Size	Washery shipments			Dredge shipments			Grand total		
	Outside region	Local sales	Total	Outside region	Local sales	Total	Outside region	Local sales	Total
NET TONS									
Lump [2] and Broken							87,420	19,007	106,427
Egg							1,141,548	5,285	1,146,833
Stove	12,657	95	12,752				8,288,021	153,975	8,441,996
Chestnut	51,745	4,180	55,925				9,495,095	672,827	10,167,922
Pea	16,096	6,308	22,404	81	517	598	2,685,522	1,009,123	3,694,645
Total domestic	80,498	10,583	91,081	81	517	598	21,697,606	1,860,217	23,557,823

Buckwheat No. 1	43,353	8,446	51,799	9,707	1,152	10,859	4,919,029	494,289	5,413,318
Buckwheat No. 2 (Rice)	43,099	2,640	45,739	4,976	1,378	6,354	2,869,122	345,970	3,215,092
Buckwheat No. 3 (Barley)	101,319	1,350	102,669	182,854	9,375	192,229	3,566,789	571,369	4,138,158
Buckwheat No. 4	442,867	1,719	444,586	136,025	31,210	167,235	2,134,773	327,853	2,462,626
Other (including silt)	668,979	37,694	706,673	322,110	165,137	487,247	2,502,177	248,722	2,750,899
Total steam	1,299,617	51,849	1,351,466	655,672	208,252	863,924	15,991,890	1,988,203	17,980,093
Grand total	1,380,115	62,432	1,442,547	655,753	208,769	864,522	37,689,496	3,848,420	41,537,916
VALUE									
Lump [2] and Broken							$1,023,700	$212,793	$1,236,493
Egg							13,237,695	63,925	13,301,620
Stove	$139,242	$1,051	$140,293				96,351,692	1,853,168	98,204,860
Chestnut	545,932	46,382	592,314				110,478,623	8,210,193	118,688,816
Pea	143,410	60,213	203,623	$411	$2,594	$3,005	25,956,996	10,279,788	36,236,784
Total domestic	828,584	107,646	936,230	411	2,594	3,005	247,048,706	20,619,867	267,668,573
Buckwheat No. 1	256,030	50,701	306,731	55,074	3,109	58,183	32,198,782	3,472,507	35,671,289
Buckwheat No. 2 (Rice)	224,373	14,839	239,212	24,794	4,773	29,567	15,888,822	2,052,907	17,941,729
Buckwheat No. 3 (Barley)	407,554	5,776	413,330	521,051	22,598	543,649	15,078,862	2,663,137	17,741,999
Buckwheat No. 4	1,341,519	5,157	1,346,676	367,261	80,078	447,339	6,648,800	951,942	7,600,742
Other (including silt)	1,950,770	76,322	2,027,092	712,367	335,323	1,047,690	6,995,246	515,361	7,510,607
Total steam	4,180,246	152,795	4,333,041	1,680,547	445,881	2,126,428	76,810,512	9,655,854	86,466,366
Grand total	5,008,830	260,441	5,269,271	1,680,958	448,475	2,129,433	323,859,218	30,275,721	354,134,939
AVERAGE VALUE PER TON									
Lump [2] and Broken							11.71	11.20	11.62
Egg							11.60	12.10	11.60
Stove	11.00	11.06	11.00				11.63	12.04	11.63
Chestnut	10.55	11.10	10.59				11.64	12.20	11.67
Pea	8.91	9.55	9.09	5.07	5.02	5.03	9.67	10.19	9.81
Total domestic	10.29	10.17	10.28	5.07	5.02	5.03	11.39	11.08	11.36
Buckwheat No. 1	5.91	6.00	5.92	5.67	2.70	5.36	6.55	7.03	6.59
Buckwheat No. 2 (Rice)	5.21	5.62	5.23	4.98	3.46	4.65	5.54	5.93	5.58
Buckwheat No. 3 (Barley)	4.02	4.28	4.03	2.85	2.41	2.83	4.23	4.66	4.29
Buckwheat No. 4	3.03	3.00	3.03	2.70	2.57	2.67	3.11	2.90	3.09
Other (including silt)	2.92	2.02	2.87	2.21	2.03	2.15	2.80	2.07	2.73
Total steam	3.22	2.95	3.21	2.56	2.14	2.46	4.80	4.86	4.81
Grand total	3.63	4.17	3.65	2.56	2.15	2.46	8.59	7.87	8.53

[1] Figures of shipments from breakers include some culm-bank coal handled in breakers.
[2] Quantity of Lump included is insignificant.

TABLE 9.—Pennsylvania anthracite produced in 1949, by counties

County	Total shipments		Sold to local trade		Colliery fuel		Total production	
	Net tons	Value [1]	Net tons	Value	Net tons	Value	Net tons	Value [1]
Carbon	2,309,367	$18,997,690	45,955	$456,290	55,369	$426,276	2,410,691	$19,880,256
Columbia	1,161,179	10,672,549	54,943	446,209	35,082	73,359	1,251,204	11,192,117
Dauphin and Susquehanna	195,930	688,096	158,870	359,517	173	462	354,973	1,048,075
Lackawanna	4,954,556	44,711,033	900,545	8,611,504	283,627	839,649	6,138,728	54,162,186
Lancaster, Lebanon, Northampton, and Snyder [2]	305,334	672,710	3,484	11,005			308,818	683,715
Luzerne	13,187,670	126,392,569	1,734,757	13,729,927	580,780	1,833,071	15,503,207	141,955,567
Northumberland	4,194,358	30,987,070	384,855	2,457,282	33,990	70,367	4,613,203	33,514,719
Schuylkill	11,369,159	90,626,956	556,864	4,125,228	174,787	630,328	12,100,810	95,382,512
Sullivan	11,943	110,545	8,147	78,759			20,090	189,304
Total	37,689,496	323,859,218	3,848,420	30,275,721	1,163,808	3,873,512	42,701,724	358,008,451

[1] Value given for shipments is value at which coal left possession of producing company and does not include margins of separately incorporated sales companies.
[2] Counties producing dredge coal only.

TABLE 10.—Sizes of Pennsylvania anthracite shipped from breakers, 1945–49, by regions, in percent of total

[Note that shipments of dredge and washery coal are not included]

Size	Percent of total shipments									
	Lehigh region					Schuylkill region				
	1945	1946	1947	1948	1949	1945	1946	1947	1948	1949
Lump [1] and Broken	0.6	0.6	0.7	0.8	0.4	0.1	0.1	0.7	0.7	0.3
Egg	5.8	6.5	5.0	5.7	2.9	5.9	5.2	5.3	5.8	3.1
Stove	19.3	19.2	20.0	20.5	20.6	16.1	17.1	15.9	16.5	17.5
Chestnut	22.1	21.5	21.7	21.6	22.8	21.8	22.7	21.2	21.0	22.3
Pea	8.9	8.2	8.2	8.2	7.7	8.9	8.2	7.6	8.0	8.3
Total domestic	56.7	56.0	55.6	56.8	54.4	52.8	53.3	50.7	52.0	51.5
Buckwheat No. 1	13.6	13.7	13.5	13.0	13.1	15.4	15.0	14.1	14.0	14.2
Buckwheat No. 2 (Rice)	9.2	9.2	8.7	8.6	8.1	9.5	8.5	8.6	8.7	8.9
Buckwheat No. 3 (Barley)	9.9	10.4	10.1	9.3	9.7	14.3	13.9	14.6	14.4	12.6
Buckwheat No. 4	3.5	3.3	5.6	6.4	7.9	6.5	6.8	9.0	6.8	6.3
Other (including silt)	7.1	7.4	6.5	5.9	6.8	1.5	2.5	3.0	4.1	6.5
Total steam	43.3	44.0	44.4	43.2	45.6	47.2	46.7	49.3	48.0	48.5

Size	Wyoming region					Sullivan County				
Lump [1] and Broken	0.2	0.2	0.3	0.2	0.2					
Egg	7.4	7.3	6.5	6.3	3.4					
Stove	27.6	27.2	27.0	28.3	29.4	25.3	18.9	8.5	20.5	32.0
Chestnut	30.2	30.0	29.5	29.4	31.7	28.4	20.8	29.7	30.9	38.0
Pea	6.3	6.5	6.8	6.5	6.7	12.7	12.3	15.4	10.9	10.0
Total domestic	71.7	71.2	70.1	70.7	71.4	66.4	52.0	53.6	62.3	80.0
Buckwheat No. 1	13.3	12.9	13.1	12.7	13.4	13.0	16.4	10.2	8.0	2.1
Buckwheat No. 2 (Rice)	6.4	6.5	6.5	6.8	7.0	2.3	30.2	.6		
Buckwheat No. 3 (Barley)	6.4	6.3	6.8	6.5	6.0					
Buckwheat No. 4	1.4	2.1	1.7	1.4	1.1					
Other (including silt)	.8	1.0	1.8	1.9	1.1	18.3	1.4	35.6	29.7	17.9
Total steam	28.3	28.8	29.9	29.3	28.6	33.6	48.0	46.4	37.7	20.0

See footnote at end of table.

TABLE 10.—Sizes of Pennsylvania anthracite shipped from breakers, 1945–49, by regions, in percent of total—Continued

[Note that shipments of dredge and washery coal are not included]

Size	Total									
	Excluding Sullivan County					Including Sullivan County				
	1945	1946	1947	1948	1949	1945	1946	1947	1948	1949
Lump [1] and Broken	0.3	0.3	0.5	0.5	0.2	0.3	0.3	0.5	0.5	0.2
Egg	6.5	6.3	5.8	6.0	3.2	6.5	6.3	5.8	6.0	3.2
Stove	21.7	22.0	21.7	22.5	23.2	21.7	22.0	21.7	22.5	23.2
Chestnut	25.5	25.8	25.1	24.9	26.5	25.5	25.8	25.1	24.9	26.5
Pea	7.8	7.4	7.3	7.4	7.5	7.8	7.4	7.3	7.4	7.5
Total domestic	61.8	61.8	60.4	61.3	60.6	61.8	61.8	60.4	61.3	60.6
Buckwheat No. 1	14.1	13.9	13.5	13.3	13.7	14.1	13.9	13.5	13.3	13.7
Buckwheat No. 2 (Rice)	8.1	7.8	7.7	7.8	7.9	8.1	7.8	7.7	7.8	7.9
Buckwheat No. 3 (Barley)	10.0	9.8	10.3	9.9	9.2	9.9	9.8	10.2	9.9	9.2
Buckwheat No. 4	3.6	4.0	5.1	4.3	4.4	3.6	4.0	5.1	4.3	4.4
Other (including silt)	2.4	2.7	3.0	3.4	4.2	2.5	2.7	3.1	3.4	4.2
Total steam	38.2	38.2	39.6	38.7	39.4	38.2	38.2	39.6	38.7	39.4

[1] Quantity of Lump included is insignificant.

TABLE 11.—Sizes of Pennsylvania anthracite shipped from breakers to points outside and inside anthracite-producing area in 1949, by regions, in percent of total

[Note that shipments of dredge and washery coal are not included]

Size	Percent of total shipments								
	Lehigh region			Schuylkill region			Wyoming region		
	Sold outside region	Local sales	Total	Sold outside region	Local sales	Total	Sold outside region	Local sales	Total
Lump [1] and Broken	0.4	(2)	0.4	0.3	0.3	0.3	0.2	0.7	0.2
Egg	2.9	0.1	2.8	3.1	.2	2.9	3.4	.1	3.0
Stove	20.6	2.2	19.7	17.5	5.8	16.8	29.4	4.0	26.0
Chestnut	22.8	26.8	23.0	22.3	18.4	22.1	31.7	17.6	29.8
Pea	7.7	38.7	9.2	8.3	18.8	8.9	6.7	30.0	9.8
Total domestic	54.4	67.8	55.1	51.5	43.5	51.0	71.4	52.4	68.8
Buckwheat No. 1	13.1	14.6	13.1	14.2	9.6	13.9	13.4	14.8	13.6
Buckwheat No. 2 (Rice)	8.1	14.4	8.4	8.9	8.3	8.9	7.0	9.4	7.3
Buckwheat No. 3 (Barley)	9.7	3.2	9.4	12.6	7.0	12.2	6.0	20.6	8.0
Buckwheat No. 4	7.9	(2)	7.5	6.3	30.4	7.7	1.1	1.4	1.2
Other (including silt)	6.8	(2)	6.5	6.5	1.2	6.3	1.1	1.4	1.1
Total steam	45.6	32.2	44.9	48.5	56.5	49.0	28.6	47.6	31.2

Size	Sullivan County			Total					
				Excluding Sullivan County			Including Sullivan County		
Lump [1] and Broken				0.2	0.5	0.3	0.2	0.5	0.3
Egg				3.2	.2	2.9	3.2	.2	2.9
Stove	32.0	33.0	32.4	23.2	4.2	21.5	23.2	4.3	21.5
Chestnut	38.0	41.4	39.6	26.5	18.6	25.8	26.5	18.7	25.8
Pea	10.0	6.6	8.4	7.5	28.1	9.3	7.5	28.0	9.3
Total domestic	80.0	81.0	80.4	60.6	51.6	59.8	60.6	51.7	59.8
Buckwheat No. 1	2.1	6.0	3.7	13.7	13.6	13.6	13.7	13.5	13.6
Buckwheat No. 2 (Rice)				7.9	9.6	8.1	7.9	9.6	8.1
Buckwheat No. 3 (Barley)				9.2	15.7	9.8	9.2	15.7	9.8
Buckwheat No. 4				4.4	8.3	4.7	4.4	8.2	4.7
Other (including silt)	17.9	13.0	15.9	4.2	1.2	4.0	4.2	1.3	4.0
Total steam	20.0	19.0	19.6	39.4	48.4	40.2	39.4	48.3	40.2

[1] Quantity of Lump included is insignificant.
[2] Less than 0.05 percent.

By Weeks and Months.—Weekly production figures for anthracite as published in the regular weekly Anthracite and Beehive Coke reports are estimated from records of railroad carloadings and from reports obtained from trade sources. The weekly and monthly figures have been adjusted to the total annual anthracite production as obtained by a direct mail canvass of the operators. Tables 12 and 13 summarize weekly and monthly production of anthracite in 1949.

TABLE 12.—Estimated weekly production of Pennsylvania anthracite in 1949

Week ended—	Net tons	Week ended—	Net tons
Jan. 8	1,033,000	July 16	1,035,000
15	1,051,000	23	1,060,000
22	861,000	30	966,000
29	653,000	Aug. 6	690,000
Feb. 5	687,000	13	697,000
12	749,000	20	795,000
19	698,000	27	922,000
26	813,000	Sept. 3	888,000
Mar. 5	697,000	10	789,000
12	701,000	17	945,000
19	189,000	24	37,000
26	107,000	Oct. 1	68,000
Apr. 2	961,000	8	1,100,000
9	963,000	15	1,260,000
16	825,000	22	1,231,000
23	803,000	29	1,181,000
30	964,000	Nov. 5	1,131,000
May 7	983,000	12	1,264,000
14	998,000	19	1,134,000
21	1,051,000	26	781,000
28	1,180,000	Dec. 3	1,018,000
June 4	965,000	10	636,000
11	1,327,000	17	618,000
18	121,000	24	616,000
25	1,140,000	31	408,000
July 2	63,000		
9	849,000	Total	42,702,000

TABLE 13.—Estimated monthly production of Pennsylvania anthracite, 1942–49, in thousands of net tons [1]

Month	1942	1943	1944	1945	1946	1947	1948	1949
January	4,560	4,466	4,970	4,219	4,968	5,172	4,929	3,725
February	4,801	5,203	5,811	4,471	4,774	4,254	4,682	2,930
March	5,116	5,855	5,512	5,269	5,476	4,984	4,935	2,375
April	5,185	5,337	5,141	5,124	5,069	4,293	4,445	3,725
May	4,873	5,219	5,781	2,083	5,453	4,564	4,874	4,407
June	5,153	3,244	5,558	5,667	3,625	4,624	4,597	3,406
July	5,374	5,698	4,905	4,944	5,248	4,098	4,372	3,925
August	5,212	5,653	5,558	4,656	5,428	5,011	5,129	3,710
September	5,459	5,474	5,380	4,640	5,033	5,158	5,015	2,114
October	5,132	5,359	5,538	5,304	5,393	5,524	4,969	4,979
November	4,824	4,140	5,029	4,559	4,975	4,629	4,687	4,657
December	4,639	4,996	4,518	3,998	5,065	4,879	4,506	2,749
Total	60,328	60,644	63,701	54,934	60,507	57,190	57,140	42,702

[1] Production is estimated from weekly carloadings as reported by the Association of American Railroads and includes mine fuel, coal sold locally, and dredge coal. Includes some "bootleg" coal purchased by legitimate operators and prepared at their breakers.

Culm-Bank Coal.—The recovery of coal from culm banks has been declining consistently since the peak of 9,600,180 tons reached in 1944; the production of 4,429,144 tons from this source in 1949 was a decline of 21 percent from the 1948 output and the lowest tonnage recovered from the banks since 1941. The culm banks in the anthracite region have been a source of coal supply for many years and were especially valuable during the coal shortages in World War II. However, coal available from this source is limited and it can be expected that the quantities recovered from the banks will decline from year to year. Tables 14 and 15 give details on production of anthracite from culm banks.

TABLE 14.—Production of Pennsylvania anthracite from culm banks, by regions, 1934–49, in net tons

Year	Lehigh	Schuylkill	Wyoming	Sullivan County	Total
1934	185,213	1,332,503	625,516		2,143,232
1935	192,790	1,748,960	760,718		2,702,468
1936	136,058	2,532,116	525,798		3,193,972
1937	101,239	2,178,482	442,878		2,722,599
1938	53,037	1,941,896	345,511		2,340,444
1939	64,180	2,159,548	360,086		2,583,814
1940	192,878	2,109,557	480,603		2,783,038
1941	326,755	2,881,049	449,062		3,656,866
1942	745,934	3,529,757	459,373		4,735,064
1943	1,944,047	4,577,917	1,041,841	19,893	7,583,698
1944	2,125,317	5,787,036	1,673,994	13,833	9,600,180
1945	2,086,864	4,936,907	1,728,440	34,448	8,786,659
1946	1,875,590	4,752,141	1,780,874	22,487	8,431,092
1947	1,044,501	3,947,016	1,409,217	2,912	6,403,646
1948	796,114	3,729,542	1,098,123		5,623,779
1949	694,763	2,778,131	956,250		4,429,144

TABLE 15.—Culm-bank coal put through breakers, 1945–49, by fields, in net tons

Year	Northern	Eastern Middle	Western Middle	Southern	Total
1945	[1] [2] 996,037	[2] 698,876	2,335,200	2,206,187	6,236,300
1946	[1] 856,247	708,012	1,902,369	1,845,163	5,311,791
1947	[1] 525,732	249,151	1,607,166	2,099,299	4,481,348
1948	393,787	152,827	1,871,847	1,571,119	3,989,580
1949	371,787	193,565	1,366,775	1,081,585	3,013,712

[1] A small quantity of culm-bank coal was put through breakers in Sullivan County.
[2] Includes some washery coal.

Historical Statistics.—Historical data on the Pennsylvania anthracite industry, 1890–1949, are given in table 16.

TABLE 16.—Statistical trends in the Pennsylvania anthracite industry, 1890–1949

Year	Production (net tons)	Value of production	Average value per net ton	Exports [1] (net tons)	Imports [1] (net tons)	Apparent consumption [2] (net tons)	Average number of employees	Average number of days worked	Average tons per man per day	Average tons per man per year	Quantity cut by machines [3] (net tons)	Quantity produced by stripping [4] (net tons)	Quantity loaded mechanically underground [5] (net tons)
1890	46,468,641	$66,383,772	$1.43	889,655	16,962	45,596,000	126,000	200	1.85	369	--------	--------	--------
1891	50,665,431	73,944,735	1.46	964,601	42,120	49,743,000	126,350	203	1.98	401	--------	--------	--------
1892	52,472,504	82,442,000	1.57	953,836	72,865	51,592,000	129,050	198	2.06	407	--------	--------	--------
1893	53,967,543	85,687,078	1.59	1,493,281	60,220	52,534,000	132,944	197	2.06	406	--------	--------	--------
1894	51,921,121	78,488,063	1.51	1,613,500	100,876	50,408,000	131,603	190	2.08	395	--------	--------	--------
1895	57,999,337	82,019,272	1.41	1,647,195	158,297	56,510,000	142,917	196	2.07	406	--------	--------	--------
1896	54,346,081	81,748,651	1.50	1,512,000	113,892	52,948,000	148,991	174	2.10	365	--------	--------	--------
1897	52,611,681	79,301,954	1.51	1,454,620	27,478	51,185,000	149,884	150	2.34	351	--------	--------	--------
1898	53,382,645	75,414,537	1.41	1,513,062	3,527	51,873,000	145,504	152	2.41	367	--------	--------	--------
1899	60,418,005	88,142,130	1.46	1,912,732	68	58,505,000	139,608	173	2.50	433	--------	--------	--------
1900	57,367,915	85,757,851	1.49	1,853,163	132	55,515,000	144,206	166	2.40	398	--------	--------	--------
1901	67,471,667	112,504,020	1.67	2,232,504	320	65,239,000	145,309	196	2.37	464	--------	--------	--------
1902	41,373,595	76,173,586	1.84	1,016,934	190,636	40,547,000	148,141	116	2.40	279	--------	--------	--------
1903	74,607,068	152,036,448	2.04	2,249,920	196,837	72,554,000	150,483	206	2.41	496	--------	--------	--------
1904	73,156,709	138,974,020	1.90	2,495,799	81,232	70,742,000	155,861	200	2.35	469	--------	--------	--------
1905	77,659,850	141,879,000	1.83	2,497,581	38,350	75,201,000	165,406	215	2.18	470	--------	--------	--------
1906	71,282,411	131,917,694	1.85	2,483,005	36,236	68,836,000	162,355	195	2.25	439	--------	--------	--------
1907	85,604,312	163,584,056	1.91	3,021,841	11,085	82,594,000	167,234	220	2.33	512	--------	--------	--------
1908	83,268,754	158,178,849	1.90	3,082,641	18,462	80,205,000	174,174	200	2.39	478	--------	--------	--------
1909	81,070,359	149,181,587	1.84	3,183,840	8,574	77,890,000	[6] 171,195	205	(7)	(7)	--------	--------	--------
1910	84,485,236	160,275,302	1.90	3,384,222	9,180	81,110,000	169,497	220	2.17	498	--------	--------	--------
1911	90,464,067	175,189,392	1.94	3,980,479	2,759	86,486,000	172,585	246	2.13	524	69,907	--------	--------
1912	84,361,598	177,622,626	2.11	4,131,444	1,870	80,232,000	174,030	231	2.10	485	246,216	--------	--------
1913	91,524,922	195,181,127	2.13	4,652,912	1,004	85,474,000	175,745	257	2.02	520	555,776	--------	--------
1914	90,821,507	188,181,399	2.07	4,289,873	17,696	84,041,000	179,679	245	2.06	505	916,596	--------	--------
1915	88,995,061	184,653,498	2.07	3,965,255	814	88,144,000	176,552	230	2.19	504	1,307,756	1,121,603	--------
1916	87,578,493	202,009,561	2.31	4,665,530	6,000	87,118,000	159,869	253	2.16	548	1,839,506	1,987,800	--------
1917	99,611,811	283,650,723	2.85	6,007,306	13,000	94,068,000	154,174	285	2.27	646	1,955,223	2,301,588	--------
1918	98,826,084	336,480,347	3.40	4,967,808	37,272	92,775,000	147,121	293	2.29	672	1,857,514	2,360,183	--------
1919	88,092,201	364,926,950	4.14	4,976,598	82,818	81,518,000	154,571	266	2.14	570	1,575,205	2,006,879	--------
1920	89,598,249	434,252,198	4.85	5,403,749	31,748	85,786,000	145,074	271	2.28	618	938,073	2,054,441	--------
1921	90,473,451	452,304,903	5.00	4,677,368	8,894	81,950,000	159,499	271	2.09	567	979,145	2,027,790	--------
1922	54,683,022	273,700,125	5.01	2,649,457	233,528	56,799,000	156,849	151	2.31	349	502,793	949,745	--------
1923	93,339,009	506,786,768	5.43	5,090,138	300,360	86,914,000	157,743	268	2.21	592	1,208,542	2,263,098	--------
1924	87,926,862	477,230,852	5.43	4,017,785	117,951	80,717,000	160,009	274	2.00	550	1,423,884	1,865,677	--------
1925	61,817,149	327,664,512	5.30	3,179,006	382,894	64,061,000	160,312	182	2.12	386	941,189	1,578,478	--------
1926	84,437,452	474,164,252	5.62	4,029,683	813,956	77,221,000	165,386	244	2.09	511	931,650	2,401,356	--------
1927	80,095,564	420,941,726	5.26	3,325,507	119,030	74,672,000	165,259	225	2.15	485	1,171,888	2,153,156	[6] 2,223,281
1928	75,348,069	393,637,690	5.22	3,336,272	384,707	73,650,000	160,681	217	2.17	469	1,289,809	2,422,924	[6] 2,351,074
1929	73,828,195	385,642,751	5.22	3,406,369	487,172	71,457,000	151,501	225	2.16	487	1,159,910	1,911,766	3,470,158
1930	69,384,837	354,574,191	5.11	2,551,659	674,812	67,628,000	150,804	208	2.21	460	1,410,123	2,536,288	4,467,750

1931	59,645,652	296,354,586	4.97	1,778,308	637,951	58,408,000	139,431	181	2.37	428	1,587,265	3,813,237	4,384,780
1932	49,855,221	222,375,129	4.46	1,803,355	607,097	50,500,000	121,243	162	2.54	411	1,674,223	3,980,973	5,433,340
1933	49,541,344	206,718,405	4.17	1,084,562	456,252	49,600,000	104,633	182	2.60	473	1,648,249	4,932,069	6,557,267
1934	57,168,291	244,152,245	4.27	1,297,610	478,118	55,500,000	109,050	207	2.53	524	1,981,088	5,798,138	9,284,486
1935	52,158,783	210,130,565	4.03	1,608,549	571,439	51,100,000	103,269	189	2.68	505	1,848,095	5,187,072	9,279,057
1936	54,579,535	227,003,538	4.16	1,678,024	614,639	53,200,000	102,081	192	2.79	535	2,162,744	6,203,267	10,827,946
1937	51,856,433	197,598,849	3.81	1,914,173	395,737	50,400,000	99,085	189	2.77	523	1,984,512	5,696,018	10,683,837
1938	46,099,027	180,600,167	3.92	1,908,911	362,895	45,200,000	96,417	171	2.79	478	1,588,407	5,095,341	10,151,669
1939	51,487,377	187,175,824	3.64	2,590,000	298,153	49,700,000	93,138	183	3.02	553	1,881,884	5,486,479	11,773,833
1940	51,484,640	205,489,814	3.99	2,667,632	135,436	49,000,000	91,313	186	3.02	562	1,816,483	6,352,700	12,326,000
1941	[8] 56,368,267	240,275,126	4.26	3,380,189	74,669	52,700,000	88,054	203	[9] 3.04	617	1,855,422	7,316,574	13,441,987
1942	[8] 60,327,729	271,678,380	4.50	4,438,588	140,115	56,500,000	82,121	239	[9] 2.95	705	2,285,640	9,070,933	14,741,459
1943	[8] 60,643,620	306,815,018	5.06	4,188,680	166,020	57,100,000	79,153	270	[9] 2.78	751	1,624,883	8,989,387	14,745,793
1944	[8] 63,701,363	354,582,884	5.57	4,185,933	11,847	59,400,000	77,591	292	[9] 2.79	815	1,336,082	10,953,030	14,975,146
1945	[8] 54,933,909	328,944,435	5.90	3,691,247	149	51,600,000	72,842	269	[9] 2.79	751	1,210,171	10,056,325	13,927,955
1946	[8] 60,506,873	413,417,070	6.83	6,497,245	9,556	58,900,000	78,145	271	[9] 2.84	770	1,232,828	12,858,930	15,619,162
1947	[8] 57,190,009	418,019,486	7.22	8,509,995	10,350	48,200,000	78,600	259	[9] 2.78	720	1,209,983	12,603,545	16,054,011
1948	[8] 57,139,948	467,051,800	8.17	6,675,914	945	50,200,000	76,215	265	[9] 2.81	745	1,016,757	13,352,874	15,742,368
1949	42,701,724	358,008,451	8.38	4,942,670	----------	37,700,000	75,377	195	2.87	560	557,599	10,376,808	11,858,088

[1] U. S. Department of Commerce.
[2] Prior to 1913 the figures of consumption take no account of producers' stocks, there being no data available for this item.
[3] Data first collected in 1911.
[4] Data first collected in 1915.
[5] Data first collected in 1929.
[6] As reported by the Commonwealth of Pennsylvania, Department of Mines.
[7] Data not available.
[8] Includes some "bootleg" coal purchased by legitimate operators and prepared at their breakers.
[9] Output per man per day calculated on legitimate tonnages only; "bootleg" purchases excluded.

"Bootleg" Coal.—According to the Anthracite Committee the production of so-called bootleg coal in 1949 totaled 1,257,218 tons, a substantial decline from the output of 1,839,227 tons reported in 1948. With the exception of the war year 1945, the output in 1949 from this source was the lowest since the depression years of the early 1930's. Although the output declined substantially in 1949 there was a 12-percent increase in both the number of active holes, and in the men employed, over 1948. A total of nine fatal accidents occurred in this type of mining in 1949. Details on "bootleg" mining for the period 1941–49 are given in tables 17 and 18.

TABLE 17.—Production, purchases by recognized operators, and fatalities at "bootleg" operations in the Pennsylvania anthracite industry, 1941–49

Year	Production (net tons) [1]	Purchased for preparation by recognized operations (net tons) [2]	Number of fatalities [1]	Year	Production (net tons) [1]	Purchased for preparation by recognized operations (net tons) [2]	Number of fatalities [1]
1941	6,300,000	1,902,481	61	1946	1,448,529	352,112	19
1942	3,931,000	2,616,839	45	1947	1,634,635	604,060	15
1943	1,912,467	1,265,617	22	1948	1,839,227	544,475	12
1944	1,332,957	506,842	21	1949	1,257,218	442,541	9
1945	1,026,000	260,342	16				

[1] Anthracite Committee, Harrisburg, Pa.
[2] As reported to Federal Bureau of Mines.

TABLE 18.—Number of men employed in "bootleg" operations in the Pennsylvania anthracite industry, 1941–49

[Anthracite Committee, Harrisburg, Pa.]

Date of survey	Number of "bootleg" operations	Average number of men employed	Date of survey	Number of "bootleg" operations	Average number of men employed
Mar. 31, 1941	3,006	10,762	Mar 7, 1945	502	1,806
May 1, 1942	2,029	7,554	Mar 30, 1946	526	1,939
Dec. 15, 1942	1,363	4,967	Mar 31, 1947	863	2,817
Apr. 20, 1943	1,065	3,607	Mar 31, 1948	835	2,825
Oct. 14, 1943	791	2,725	Mar 31, 1949	772	2,617
Mar. 31, 1944	652	2,220	Feb 28, 1950	868	2,928

VALUE OF SALES

Under the impact of higher costs of labor and materials, the average value per net ton of anthracite at the mines has been increasing consistently since 1939. The average sales realization per net ton on breaker shipments in 1949 was $8.90 compared with $8.67 in 1948; when colliery fuel, local sales, river coal, and washery coal are included, the average per ton value of the 1949 production is $8.38 compared with $8.17 in 1948. The average sales realization figures in this study represent value at the breaker, washery, or dredge, and the reporting company is asked to "exclude selling expenses"; therefore, when a producing company sells its output to a separately organized sales company, the value reported will exclude the margin of the sales company and may therefore be somewhat less than the circular price at which the coal is placed on the open market.

TABLE 19.—Average sales realization per net ton on Pennsylvania anthracite shipments from breakers, 1945–49, by regions and sizes

[Value does not include margins of separately incorporated sales companies]

Size	Lehigh region					Schuylkill region				
	1945	1946	1947	1948	1949	1945	1946	1947	1948	1949
Lump [1] and Broken	$7.98	$9.14	$10.21	$11.47	$11.98	$8.17	$9.43	$10.10	$11.09	$11.56
Egg	8.10	9.32	10.23	11.42	11.81	8.18	9.48	10.11	11.22	11.57
Stove	8.11	9.42	10.23	11.44	11.80	8.18	9.52	10.02	11.34	11.56
Chestnut	8.09	9.40	10.24	11.45	11.81	8.20	9.54	10.07	11.38	11.62
Pea	6.56	7.72	8.44	9.50	9.86	6.66	7.89	8.17	9.33	9.56
Total domestic	7.86	9.15	9.97	11.16	11.53	7.93	9.27	9.77	11.08	11.27
Buckwheat No. 1	4.76	5.51	5.97	6.52	6.64	4.90	5.55	5.76	6.39	6.43
Buckwheat No. 2 (Rice)	3.87	4.50	4.93	5.53	5.56	3.89	4.54	4.78	5.37	5.46
Buckwheat No. 3 (Barley)	2.67	3.09	3.57	4.14	4.36	2.61	3.09	3.52	4.03	4.26
Buckwheat No. 4	2.02	2.26	2.65	2.96	3.23	1.81	2.14	2.39	2.84	3.11
Other (including silt)	1.62	1.95	2.21	2.50	2.79	1.48	1.83	2.16	2.68	2.91
Total steam	3.36	3.88	4.25	4.73	4.80	3.43	3.94	4.09	4.68	4.79
Total all sizes	5.91	6.83	7.43	8.38	8.47	5.81	6.78	6.97	7.98	8.12

Size	Wyoming region					Sullivan County				
Lump [1] and Broken	$8.00	$9.26	$9.87	$11.06	$11.66	------	------	------	------	------
Egg	8.11	9.33	10.01	11.15	11.54	------	------	------	------	------
Stove	8.07	9.33	9.98	11.24	11.61	$7.41	$9.19	$11.36	$9.67	$10.96
Chestnut	8.09	9.34	9.98	11.20	11.60	7.53	9.13	10.20	9.59	10.98
Pea	6.60	7.74	8.19	9.31	9.70	6.40	7.95	9.28	7.86	8.88
Total domestic	7.95	9.19	9.81	11.04	11.42	7.27	8.87	10.12	9.31	10.71
Buckwheat No. 1	4.79	5.51	5.81	6.50	6.63	4.08	4.70	3.98	5.99	5.00
Buckwheat No. 2 (Rice)	3.95	4.52	4.84	5.48	5.63	2.55	2.62	3.14	------	------
Buckwheat No. 3 (Barley)	2.72	3.16	3.63	4.15	4.37	------	------	------	------	------
Buckwheat No. 4	1.82	1.85	2.49	3.01	3.32	------	------	------	------	------
Other (including silt)	1.48	1.86	1.74	2.13	2.81	2.27	1.75	1.93	4.10	3.26
Total steam	3.89	4.38	4.67	5.30	5.63	2.99	3.31	2.39	4.50	3.44
Total all sizes	6.80	7.81	8.27	9.35	9.77	5.83	6.20	6.54	7.50	9.26

Size	Total									
	Excluding Sullivan County					Including Sullivan County				
Lump [1] and Broken	$8.02	$9.23	$10.07	$11.19	$11.71	$8.02	$9.23	$10.07	$11.19	$11.71
Egg	8.13	9.38	10.08	11.22	11.60	8.13	9.38	10.08	11.22	11.60
Stove	8.11	9.40	10.03	11.30	11.63	8.10	9.40	10.03	11.29	11.63
Chestnut	8.12	9.42	10.05	11.30	11.64	8.12	9.42	10.05	11.29	11.64
Pea	6.62	7.79	8.23	9.36	9.67	6.62	7.79	8.23	9.35	9.67
Total domestic	7.93	9.21	9.82	11.05	11.39	7.93	9.21	9.82	11.05	11.39
Buckwheat No. 1	4.79	5.53	5.82	6.46	6.55	4.79	5.53	5.82	6.46	6.55
Buckwheat No. 2 (Rice)	3.91	4.52	4.83	5.45	5.54	3.91	4.52	4.83	5.45	5.54
Buckwheat No. 3 (Barley)	2.65	3.11	3.56	4.09	4.31	2.65	3.11	3.56	4.09	4.31
Buckwheat No. 4	1.85	2.09	2.46	2.89	3.18	1.85	2.09	2.46	2.89	3.18
Other (including silt)	1.57	1.90	2.06	2.49	2.87	1.58	1.90	2.06	2.50	2.87
Total steam	3.56	4.08	4.32	4.90	5.05	3.56	4.08	4.32	4.90	5.05
Total all sizes	6.26	7.25	7.65	8.67	8.90	6.26	7.25	7.65	8.67	8.90

[1] Quantity of Lump included is insignificant.

TABLE 20.—Average sales realization per net ton on Pennsylvania anthracite shipments from breakers to points outside and inside anthracite-producing area in 1949, by regions and sizes

[Value does not include margins of separately incorporated sales companies]

Size	Lehigh region			Schuylkill region			Wyoming region		
	Sold outside region	Local sales	Total	Sold outside region	Local sales	Total	Sold outside region	Local sales	Total
Lump [1] and Broken	$11.98	$11.83	$11.98	$11.56	$11.72	$11.56	$11.66	$11.12	$11.44
Egg	11.81	12.70	11.81	11.57	11.71	11.57	11.54	12.23	11.54
Stove	11.80	12.28	11.80	11.56	11.61	11.56	11.61	12.27	11.62
Chestnut	11.81	12.49	11.85	11.62	11.84	11.63	11.60	12.30	11.66
Pea	9.86	10.50	9.99	9.56	9.54	9.56	9.70	10.29	9.94
Total domestic	11.53	11.35	11.52	11.27	10.81	11.24	11.42	11.13	11.39
Buckwheat No. 1	6.64	7.31	6.68	6.43	6.59	6.44	6.63	7.13	6.70
Buckwheat No. 2 (Rice)	5.56	6.41	5.63	5.46	5.32	5.45	5.63	6.05	5.71
Buckwheat No. 3 (Barley)	4.36	4.91	4.37	4.26	4.34	4.27	4.37	4.74	4.50
Buckwheat No. 4	3.23	4.75	3.23	3.11	2.94	3.07	3.32	2.93	3.26
Other (including silt)	2.79	2.50	2.79	2.91	3.10	2.92	2.81	1.95	2.66
Total steam	4.80	6.67	4.86	4.79	4.08	4.74	5.63	5.61	5.63
Total all sizes	8.47	9.84	8.53	8.12	7.01	8.06	9.77	8.50	9.60

Size	Sullivan County			Total					
				Excluding Sullivan County			Including Sullivan County		
Lump [1] and Broken	------	------	------	$11.71	$11.20	$11.62	$11.71	$11.20	$11.62
Egg	------	------	------	11.60	12.10	11.60	11.60	12.10	11.60
Stove	$10.96	$11.00	$10.98	11.63	12.05	11.63	11.63	12.04	11.63
Chestnut	10.98	11.00	10.99	11.64	12.22	11.68	11.64	12.21	11.68
Pea	8.88	9.50	9.06	9.67	10.19	9.81	9.67	10.19	9.81
Total domestic	10.71	10.89	10.78	11.39	11.09	11.37	11.39	11.09	11.37
Buckwheat No. 1	5.00	6.60	6.07	6.55	7.05	6.60	6.55	7.05	6.60
Buckwheat No. 2 (Rice)	------	------	------	5.54	5.95	5.59	5.54	5.95	5.59
Buckwheat No. 3 (Barley)	------	------	------	4.31	4.70	4.37	4.31	4.70	4.37
Buckwheat No. 4	------	------	------	3.18	2.94	3.14	3.18	2.94	3.14
Other (including silt)	3.26	3.47	3.33	2.87	2.23	2.85	2.87	2.26	2.85
Total steam	3.44	4.46	3.84	5.05	5.24	5.08	5.05	5.24	5.08
Total all sizes	9.26	9.67	9.42	8.90	8.26	8.84	8.90	8.27	8.84

[1] Quantity of Lump included is insignificant.

TABLE 21.—Average value per ton of Pennsylvania anthracite shipments, local sales, colliery fuel, and total production, 1948–49, by regions [1]

[Values include washery and dredge coal]

Region	1948				1949			
	Shipments	Local sales	Colliery fuel	Total production	Shipments	Local sales	Colliery fuel	Total production
Lehigh	$8.17	$9.57	$5.81	$8.18	$8.23	$9.83	$6.31	$8.26
Schuylkill	7.60	6.21	2.66	7.44	7.73	6.10	2.40	7.56
Wyoming	9.17	8.45	2.59	8.75	9.55	8.36	2.95	9.13
Total, excluding Sullivan County	8.39	7.89	3.01	8.17	8.59	7.86	3.33	8.38
Sullivan County	7.50	7.53		7.51	9.26	9.67		9.42
Grand total	8.39	7.89	3.01	8.17	8.59	7.87	3.33	8.38

[1] Value given for shipments is value at which coal left possession of producing company and does not include margins of separately incorporated sales companies.

SHIPMENTS

The data shown in table 22 on the distribution of Pennsylvania anthracite are collected on a coal-year basis, as it more nearly corresponds with the heating season; therefore, no direct comparison is possible with annual statistics presented elsewhere in the chapter on production, method of movement, etc. The data were furnished voluntarily to the Bureau of Mines by producers, wholesalers, and dock operators and represent the seventh in a series of reports on the distribution of Pennsylvania anthracite.

Shipments of anthracite in the 1948–49 coal year totaled 48,407,035 net tons, as compared with 55,362,344 tons for the 1947–48 coal year. The decline was due largely to the fact that the winter of 1948–49 was one of the warmest on record, to competition of other fuels, and to a marked decrease in shipments to Europe. The Canadian market remained virtually unchanged, however, as is evidenced by the 4,389,355 net tons reported for the 1948–49 coal year. As indicated in the table, all consuming areas except the Lake States show a decline in tonnages received during the 1948–49 coal year; however, due to influence exerted by the drop in exports to Europe, the percentages shown for areas in the United States and Canada are higher than for the 1947–48 coal year.

TABLE 22.—Distribution of Pennsylvania anthracite April 1, 1948, to March 31, 1949, by States, Provinces, and countries of destination, in net tons

Destinations	Domestic sizes						Steam sizes						Total all sizes	Per-cent of total
	Broken	Egg	Stove	Chestnut	Pea	Total domestic	Buck-wheat No. 1	Rice	Barley	Buck-wheat No. 4	All other sizes	Total steam		
United States:														
New England States:														
Connecticut	3,896	24,837	353,343	384,144	35,352	801,572	59,688	39,180	40,278	-	97	139,252	940,824	1.94
Maine	-	26,182	126,537	100,668	4,714	258,101	18,503	10,272	-	-	3	28,778	286,879	.59
Massachusetts	3,321	235,377	1,075,342	601,933	45,276	1,961,249	151,804	98,337	37,271	2,611	80	290,103	2,251,352	4.65
New Hampshire	-	19,421	97,581	67,248	4,047	188,297	21,184	27,322	76,468	-	333	125,277	313,574	.65
Rhode Island	-	17,284	139,724	100,626	6,636	264,270	15,051	11,118	-	-	-	26,169	290,439	.60
Vermont	188	12,421	100,544	70,727	8,037	191,917	35,490	17,810	22,984	50	-	76,334	268,251	.56
Total	7,405	335,522	1,893,071	1,325,346	104,062	3,665,406	301,690	204,048	177,001	2,661	513	685,913	4,351,319	8.99
Middle Atlantic States:														
New Jersey	17,076	109,843	883,500	1,803,173	503,499	3,317,091	730,331	547,525	1,071,552	407,057	67,374	2,823,839	6,140,930	12.69
New York	84,849	726,433	3,416,061	3,054,210	1,017,193	8,298,746	3,328,454	1,052,509	1,121,635	413,540	300,120	6,216,258	14,515,004	29.99
Pennsylvania [1]	88,034	235,848	1,129,653	2,855,633	2,142,293	6,451,461	1,317,416	1,382,145	2,411,291	1,626,879	763,475	7,501,206	13,952,667	28.82
Total	189,959	1,072,124	5,429,214	7,713,016	3,662,985	18,067,298	5,376,201	2,982,179	4,604,478	2,447,476	1,130,969	16,541,303	34,608,601	71.50
South Atlantic States: [2]														
Delaware	52	11,891	69,648	161,681	14,278	257,550	7,003	6,381	14,912	25,173	8,904	62,373	319,923	.66
District of Columbia	50	10,013	71,165	89,842	17,804	188,874	25,917	1,205	-	-	50	27,172	216,046	.45
Maryland	1,185	31,738	205,880	219,413	33,170	491,386	69,130	7,312	24,320	3,230	331	104,323	595,709	1.23
Virginia	915	7,858	31,519	43,538	6,012	89,842	24,716	108	-	289	352	25,465	115,307	.24
Total	2,202	61,500	378,212	514,474	71,264	1,027,652	126,766	15,006	39,232	28,692	9,637	219,333	1,246,985	2.58
Lake States: [3]														
Illinois	11,633	40,429	47,374	104,192	1,869	205,497	8,780	19,929	13,741	19,926	22,444	84,820	290,317	.60
Michigan	988	43,852	132,691	99,411	3,868	280,810	8,043	12,761	-	1,037	129,113	150,954	431,764	.89
Minnesota	-	597	20,079	28,944	1,831	51,451	1,394	285	-	24,741	337	26,757	78,208	.16
Ohio	580	15,813	5,209	47,482	374	69,458	2,393	1,300	1,903	2,100	41,734	49,430	118,888	.25
Wisconsin	928	1,787	161,629	256,276	28,290	448,910	11,663	3,497	-	158,172	371,573	544,905	993,815	2.05
Total	14,129	102,478	366,982	536,305	36,232	1,056,126	32,273	37,772	15,644	205,976	565,201	856,866	1,912,992	3.95
All other States	875	11,189	12,008	95,911	3,316	123,299	9,611	1,744	703	2,469	33,933	48,460	171,759	.35
Total United States	214,570	1,582,813	8,079,487	10,185,052	3,877,859	23,939,781	5,846,541	3,240,749	4,837,058	2,687,274	1,740,253	18,351,875	42,291,656	87.37

Canada:														
Province:														
Ontario	12,374	370,872	1,342,888	1,100,836	76,329	2,903,299	131,633	102,786	4,822	3,098	4,916	247,255	3,150,554	6.51
Quebec	96	66,765	362,510	224,995	13,791	668,157	289,833	125,821	47,378	2,578	21,969	487,579	1,155,736	2.39
Other Provinces		10,755	25,214	30,630	685	67,284	9,520	6,242			19	15,781	83,065	.17
Total Canada	12,470	448,392	1,730,612	1,356,461	90,805	3,638,740	430,986	234,849	52,200	5,676	26,904	750,615	4,389,355	9.07
Other countries	729	277,611	4,300	2,183	152,665	437,438	33,729	81,289	33,248	377,284	703,036	1,288,586	1,720,024	3.56
Grand total	227,769	2,308,816	9,814,399	11,548,646	4,121,329	28,015,959	6,311,256	3,556,887	4,922,506	3,070,234	2,530,193	20,391,076	48,407,035	100.00

1 Includes "Local sales."
2 Shipments to other States generally referred to as being in the South Atlantic area are included in "All other States."
3 Shipments to Indiana are included in "All other States."

According to data compiled from records of Pennsylvania State Department of Mines anthracite shipments from the mines to destinations in the United States declined 26 percent in 1949 as compared with 1948. In 1949, 82 percent of the shipments destined to points in this country moved from the mines by rail and 18 percent by truck, as compared to 83 and 17 percent, respectively, in 1948. Pennsylvania received 86 percent of the truck shipments in 1949, New Jersey 6 percent, and New York 7 percent. Anthracite rail shipments by States of destination for 1946–49 are shown in table 23 and the movement of anthracite by truck in 1949, by months and States of destination, in table 24.

Before 1948, the annual schedule of the Bureau of Mines covering production statistics of the anthracite industry has requested data for local sales only on total tonnages sold locally within the anthracite region. However, the Bureau received so many requests for local sales data on a size basis that it was deemed advisable to insert an item in the 1948 form requesting the industry to report local sales by sizes. The inclusion of size data for local sales in 1948 and 1949 makes the Bureau's production statistics on Pennsylvania anthracite much more complete than those of previous years. As indicated in the tables, sales of anthracite within the region totaled 3,848,420 tons in 1949.

According to data compiled from records of the Massachusetts Division on the Necessaries of Life and the Anthracite Emergency Tidewater Bureau rail receipts of Pennsylvania anthracite in New England decreased 28 percent from 1948; tidewater receipts decreased 49 percent. Details on anthracite movement to New England are given in table 25. Loadings at Lake Erie ports and receipts at upper Lake docks decreased 46 and 42 percent, respectively, from 1948. A large part of the decline in Lake Erie loadings in 1949 can be attributed to the decreased use of smaller steam sizes of anthracite by briquet manufacturers in the Great Lakes region.

TABLE 23.—Rail shipments of Pennsylvania anthracite, 1946–49, by destinations, in net tons

[Pennsylvania Department of Mines]

Destination	1946	1947	1948	1949
New England States	5,367,460	4,456,476	4,600,429	3,277,034
New York	15,440,475	14,530,238	14,526,250	10,804,020
New Jersey	7,945,666	6,697,055	6,213,667	4,522,749
Pennsylvania	11,360,229	10,138,523	9,706,429	6,935,710
Delaware	287,173	295,288	283,106	237,479
Maryland	918,195	830,546	626,948	396,561
District of Columbia	280,324	228,383	214,291	152,940
Virginia	126,187	116,650	118,611	84,275
Ohio	96,179	98,729	118,735	50,673
Indiana	100,077	78,303	94,492	66,773
Illinois	343,354	285,648	286,888	152,791
Wisconsin	524,066	486,975	627,366	463,625
Minnesota	55,231	19,749	48,683	47,944
Michigan	285,351	354,643	351,304	235,703
Other States	65,502	62,575	57,070	57,148
Total United States	43,195,469	38,679,781	37,874,269	27,485,425
Canada	3,818,303	3,828,980	3,977,698	3,154,387
Other foreign countries		1,854,042	913,920	671,350
Grand total	47,013,772	44,362,803	42,765,887	31,311,162

TABLE 24.—Truck shipments of Pennsylvania anthracite in 1949, by months and by States of destination, in net tons [1]

Destination	January	February	March	April	May	June	July
Pennsylvania:							
Within region	383, 364	308, 053	268, 706	289, 299	305, 222	231, 620	121, 054
Outside region	212, 560	177, 281	140, 238	139, 805	184, 608	146, 631	118, 130
New York	37, 437	30, 388	26, 030	23, 262	24, 648	28, 627	25, 886
New Jersey	35, 766	29, 282	25, 180	23, 155	35, 307	27, 332	25, 045
Delaware	2, 527	2, 289	2, 050	1, 194	888	307	186
Maryland	4, 756	4, 513	2, 480	1, 416	2, 924	1, 722	1, 293
District of Columbia		84	117		86		
Other States	2, 651	1, 689	1, 529	1, 824	1, 360	922	737
Total: 1949	679, 061	553, 579	466, 330	479, 955	555, 043	437, 161	292, 331
1948	791, 656	803, 077	724, 253	577, 890	585, 467	556, 038	326, 464

Destination	August	September	October	November	December	Total	Percent of total trucked
Pennsylvania:							
Within region	183, 524	192, 794	322, 092	367, 753	356, 044	3, 329, 525	54. 7
Outside region	133, 254	117, 502	177, 105	171, 306	210, 063	1, 928, 503	31. 7
New York	27, 075	20, 504	52, 441	46, 475	44, 436	387, 209	6. 4
New Jersey	28, 026	25, 003	45, 587	37, 970	35, 303	372, 956	6. 1
Delaware	372	449	1, 990	2, 548	3, 027	17, 827	. 3
Maryland	1, 380	1, 283	3, 235	4, 022	2, 922	31, 946	. 5
District of Columbia	52			64		403	(2)
Other States	697	1, 196	2, 882	2, 008	2, 260	19, 755	. 3
Total: 1949	374, 380	358, 731	605, 332	632, 146	654, 075	6, 088, 124	100. 0
1948	482, 944	545, 118	699, 617	562, 657	755, 014	7, 610, 195	100. 0

[1] Compiled from reports of Pennsylvania Department of Mines.
[2] Less than 0.05 percent.

TABLE 25.—Receipts of anthracite in New England, 1917, 1920, 1923, 1927, and 1940–49, in thousands of net tons

Year	Receipts by tidewater [1]						Receipts by rail [1]	Imports [2]	Total receipts of Pennsylvania anthracite [3]
	Maine	New Hampshire	Massachusetts	Rhode Island	Connecticut	Total			
1917	432	47	2, 222	565	1, 165	4, 421	7, 259	1	11, 679
1920	307	6	2, 015	450	743	3, 521	7, 804	1	11, 324
1923	437	27	2, 216	511	891	4, 082	8, 102	145	12 039
1927	242	33	1, 220	311	615	2, 421	6, 725	106	9, 040
1940	48	4	350	74	172	648	4, 174	135	4, 687
1941	57	9	348	58	210	682	4, 870	75	5, 477
1942	(4)	(4)	(4)	(4)	(4)	581	5, 393	139	5, 835
1943						575	5, 310	164	5, 721
1944						398	5, 836	12	6, 222
1945						331	4, 750	(5)	5, 081
1946						299	5, 344		5, 643
1947						240	4, 498		4, 738
1948						217	4, 646		4, 863
1949						110	3, 336		3, 446

[1] Commonwealth of Massachusetts, Division on the Necessaries of Life.
[2] U. S. Department of Commerce.
[3] Total receipts by rail and by tidewater less imports.
[4] Data not available.
[5] Less than 1,000 tons.

Shipments of anthracite from the Lehigh, Schuylkill, and Wyoming regions, 1890–1949, inclusive, are illustrated graphically in figure 1.

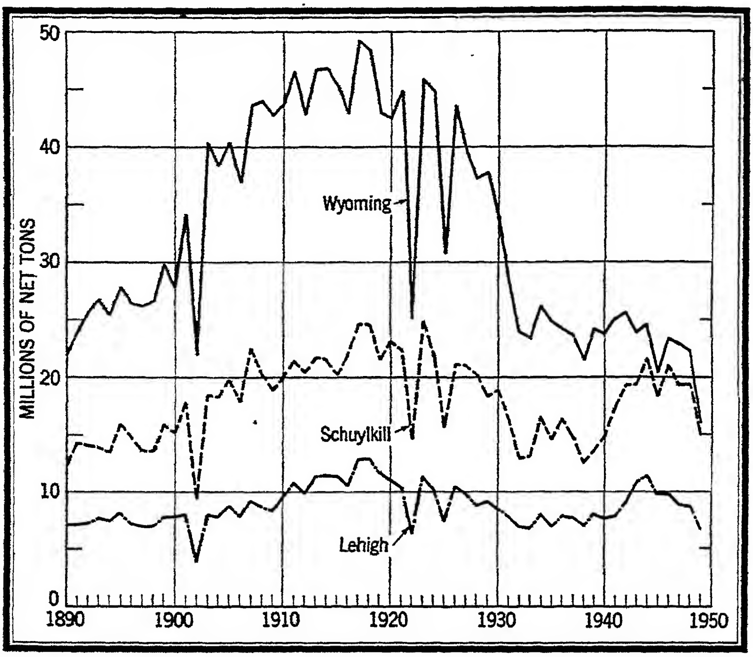

FIGURE 1.—Anthracite shipped from the Lehigh, Schuylkill, and Wyoming regions, 1890–1949.

CONSUMPTION

Anthracite is primarily a space-heating fuel, and the over-all consumption is related directly to the intensity of the weather. The winter months of 1949 were abnormally warm; this was responsible largely for the sharp decline in the apparent consumption of anthracite to 37,700,000 tons, a 25-percent decrease from 1948. Another important factor was, of course, the strong competition of natural gas and fuel oil. Apparent consumption is calculated on the basis of production, plus imports, minus exports, and changes in producers' stocks; but no attempt is made to reflect changes in retail dealers' stocks, as data for this group are incomplete. Consumption by class 1 railroads in 1949 totaled 735,718 tons, a decline of 19 percent from 1948; electric power utilities consumed 3,353,857 tons, a decline of 15 percent; anthracite used in the manufacture of fuel briquets and packaged fuel totaled 646,897 tons in 1949, a decrease of 44 percent from 1948. Anthracite mixed with bituminous coal in making coke totaled 172,825 tons in 1949 compared with 256,175 tons in 1948.

Competitive Fuels in the United States and Principal Markets.—The New England and Middle Atlantic States, Maryland, Delaware, and the District of Columbia received 96 percent of the total shipments of anthracite to points in the United States in 1949. Data on the

consumption of all fuels in this market are not available; however, apparent consumption of anthracite, domestic coke, briquets, and heating and range oils, in terms of anthracite, totaled 80,939,000 net tons in 1949, a decrease of 16 percent from 1948. Fuel oil surpassed anthracite consumption in this area for the first time in 1947 on an equivalent B. t. u. or heating value basis, and, in 1949, accounted for 58 percent of the total consumption of the fuels indicated in table 26.

Supplies of various fuels generally used for space-heating purposes in the United States in 1949 decreased greatly from 1948. (*See* table 27.)

TABLE 26.—Apparent consumption of anthracite and selected competitive fuels in the principal anthracite markets, 1946–49

[Thousands of net tons]

Fuel	New England	New York	New Jersey	Pennsylvania	Delaware	Maryland	District of Columbia	Total	Percent of total fuels
Anthracite:									
All users: [1]									
1946	5,367	[2] 16,103	[2] 8,663	17,525	322	980	281	49,241	56.0
1947	4,457	[2] 14,924	[2] 7,177	16,127	316	895	228	44,124	48.3
1948	4,600	[2] 15,004	[2] 6,806	16,116	313	709	215	43,763	45.6
1949	3,277	[2] 11,191	[2] 4,896	12,194	255	429	153	32,395	40.1
Imports: [3]									
1946	-------	-------	-------	-------	-------	-------	-------	-------	-------
1947	-------	7	-------	-------	-------	-------	-------	7	(4)
1948	-------	-------	-------	-------	-------	1	-------	1	(4)
1949	-------	-------	-------	-------	-------	-------	-------	-------	-------
Briquets:									
Domestic use:									
1946	121	94	28	50	4	21	2	320	.4
1947	49	49	32	126	1	29	2	288	.3
1948	59	44	26	88	1	24	3	245	.3
1949	25	21	21	39	(5)	15	1	122	.2
Imports: [3]									
1946	-------	-------	-------	-------	-------	-------	-------	(5)	(4)
1947	-------	-------	-------	-------	-------	-------	-------	(5)	(4)
1948	-------	-------	-------	-------	-------	-------	-------	-------	-------
1949	-------	-------	-------	-------	-------	-------	-------	(5)	(4)
Coke:									
Domestic use:									
1946	1,085	987	469	291	3	5	(5)	2,840	3.2
1947	834	693	407	220	(5)	1	-------	2,155	2.4
1948	778	689	386	242	1	(5)	-------	2,096	2.2
1949	592	510	281	168	(5)	1	-------	1,552	1.9
Imports: [3]									
1946	(5)	11	-------	-------	-------	-------	-------	11	(4)
1947	1	-------	-------	-------	-------	-------	-------	1	(4)
1948	1	38	-------	-------	-------	-------	-------	39	(4)
1949	1	83	-------	-------	-------	-------	-------	84	-------
Oil: Heating and range: [6]									
1946	12,924	11,554	5,713	3,175	184	1,327	665	35,542	40.4
1947	16,855	12,940	7,153	4,890	257	1,929	793	44,817	49.0
1948	18,652	14,390	8,224	5,207	278	2,256	776	49,783	51.9
1949	17,353	14,086	7,735	4,418	433	2,048	713	46,786	57.8
Total fuel: [7]									
1946	19,497	28,749	14,873	21,041	513	2,333	948	87,954	100.0
1947	22,196	28,613	14,769	21,353	574	2,854	1,023	91,382	100.0
1948	24,090	30,165	15,442	21,653	593	2,990	994	95,927	100.0
1949	21,248	25,891	12,933	16,819	688	2,493	867	80,939	100.0

[1] Pennsylvania Department of Mines; illicit coal not included.
[2] An important but undetermined part of anthracite shown as shipped to New Jersey is reshipped to New York City.
[3] U. S. Department of Commerce.
[4] Less than 0.05 percent.
[5] Less than 1,000 tons.
[6] Converted to coal equivalent upon basis of 4 barrels of fuel oil equaling 1 ton of coal.
[7] Excludes bituminous coal.

TABLE 27.—Total supplies of fuels commonly used for space-heating purposes in the United States, 1937 and 1946–49

[Wherever available, figures represent quantity actually consumed for domestic heating or for space heating offices, apartments, hotels, schools, hospitals, etc. Where such figures are not available but where the fuel is known to be used chiefly for domestic or space-heating purposes, total production (or imports) is shown to indicate trend of growth]

	1937	1946	1947	1948	1949
SOLID FUELS (NET TONS)					
Anthracite:					
Production:					
Shipments of domestic sizes	29,092,974	31,607,802	29,210,251	29,509,890	21,697,606
Shipments of Buckwheat No. 1	6,859,707	7,181,843	6,557,076	6,409,788	4,919,029
Shipments of smaller steam sizes [1]	10,250,463	15,318,942	15,285,086	14,563,514	11,072,861
Local sales	2,981,391	4,435,536	4,232,871	4,795,721	3,848,420
Total commercial production	49,184,535	58,544,123	55,285,284	55,278,913	41,537,916
Exports [2]	1,914,173	6,497,245	8,509,995	6,675,914	4,942,670
Imports for consumption [2]	395,737	9,556	10,350	945	------------
Fuel briquets [3]	977,254	2,841,341	2,923,223	2,920,921	2,237,196
Packaged-fuel production	146,037	190,919	182,881	157,013	125,948
Coke:					
Oven-coke sales for domestic use	7,807,792	4,947,085	3,917,402	3,398,696	2,740,987
Beehive sales for domestic use	299,726	149,648	59,926	46,613	14,853
Imports for consumption [2]	286,364	52,188	104,093	161,400	277,507
Retort-coke sales	[4] 350,700	355,336	282,666	199,123	140,236
Petroleum-coke production	1,306,600	2,124,200	2,415,400	2,898,800	3,391,800
Anthracite and semianthracite production outside of Pennsylvania	468,852	(5)	(5)	(5)	(5)
Lignite production [6]	3,218,419	2,667,619	2,873,653	3,085,886	3,092,130
Bituminous-coal sales for domestic use	(7)	(7)	(7)	(7)	(7)
OIL (BARRELS OF 42 GALLONS)					
Oil sales for heating buildings:					
Range oil	32,259,000	60,564,000	74,114,000	84,163,000	[8] 78,529,000
Heating oils (domestic and commercial) [9]	116,617,000	189,371,000	234,761,000	258,663,000	[8] 254,902,000
Liquefied petroleum gases (domestic)	972,000	18,059,000	27,394,000	35,078,000	38,751,000
GAS (MILLION CUBIC FEET)					
Natural-gas consumption for domestic and commercial use [10]	489,234	902,622	1,087,363	1,219,402	[8] 1,366,000
Manufactured-gas sales for: [11]					
Residential use	210,959	272,797	291,274	295,797	(12)
Commercial use	42,631	62,571	68,566	71,558	(12)

[1] A considerable part of the smaller steam sizes is used by industries, railroads, and public utilities.
[2] U. S. Department of Commerce.
[3] Production plus imports less exports.
[4] Partly estimated.
[5] Data not available.
[6] An estimated one-half of total production shown is used for domestic purposes.
[7] Exact data not available.
[8] Estimated.
[9] Includes all grades of fuel oil used for heating buildings.
[10] Includes gas used for heating offices, hotels, apartments, hospitals, stores, and other large buildings, as well as houses.
[11] American Gas Association.
[12] Data not yet available.

Mechanical Stokers.—Data of the Bureau of the Census, United States Department of Commerce, show that factory sales of class 1 mechanical stokers for burning anthracite (capacity under 61 pounds of coal per hour) decreased from 9,524 units in 1948 to 4,604 units in 1949; sales of class 2 stokers (capacity 61 to 100 pounds of coal per hour) decreased from 761 units in 1948 to 478 units in 1949. Automatic anthracite-burning equipment has been improved greatly in recent years and the anthracite industry expects equipment sales to increase substantially in the next several years.

STOCKS

Stocks of anthracite held in producers' yards totaled 927,859 tons in January 1949, declined to a low of 442,117 tons in March, and then increased to 975,457 tons in December; virtually all of the coal in storage during the year was Pea and smaller sizes. Stocks of anthracite on the upper Lake docks totaled 246,825 tons in December 1949, a 35-percent decrease from those held in December 1948. Stocks held by electric power utilities increased 72 percent over 1948, while stocks of class 1 railroads declined 31 percent.

PRICES

According to Saward's Journal, f. o. b. mine prices for anthracite at the end of 1949 varied from $12.15 to $12.55 per net ton on Broken and Egg sizes; $12.25 to $12.55 on Stove and Chestnut; $10.25 to $10.60 on Pea; $7.00 to $7.25 on Buckwheat No. 1; $6.00 to $6.25 on Rice; and $4.60 on Barley. A number of companies normally sell coal of a certain grade from some mines at a small premium over the quoted circular prices. It is to be noted that the prices are f. o. b. mine quotations and differ from retail prices, which include transportation and dealer costs. Data compiled from reports of the Bureau of Labor Statistics, United States Department of Labor, showing retail prices, for certain fuels in selected cities, by months for 1949, are shown in table 28.

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TABLE 28.—Retail prices of selected fuels in 1949, by cities and months[1]

[Coal and coke, per net ton; heating oil, per 100 gallons]

City and fuel	January	February	March	April	May	June	July	August	September	October	November	December
Baltimore, Md.:[3]												
Anthracite:												
Stove	$20.14	$20.14	$20.14	$18.93	$18.93	$18.93	$18.03	$19.14	$19.49	$20.03	$20.22	$20.28
Buckwheat No. 1	14.48	14.48	14.48	13.39	13.39	13.39	13.39	13.77	14.34	14.85	14.98	14.92
Heating oil:												
Fuel oil No. 2	12.14	12.14	12.14	11.32	10.91	10.84	10.40	10.40	11.45	11.63	11.63	11.63
Boston, Mass.:												
Anthracite:												
Stove	22.02	22.25	22.25	22.25	20.75	20.75	21.50	21.50	21.75	22.50	22.50	22.50
Buckwheat No. 1	16.22	16.45	16.45	16.45	15.20	15.20	15.95	15.95	16.08	16.45	16.45	16.45
Coke: Egg	21.45	21.75	21.75	21.75	20.25	20.25	20.75	20.75	20.75	21.25	21.62	21.75
Heating oil:												
Fuel oil No. 2	12.22	12.22	12.10	11.50	11.10	11.10	11.00	10.90	11.50	11.90	11.90	11.90
Buffalo, N. Y.:[3]												
Anthracite: Stove	20.82	21.07	21.07	20.84	20.16	20.31	20.53	20.68	21.12	21.12	21.12	21.12
Coke: Nut	19.64	19.75	19.75	18.66	17.57	17.57	17.57	17.98	17.98	18.43	18.43	18.68
Heating oil:												
Fuel oil No. 2	13.84	13.84	13.53	13.03	12.62	12.29	12.29	12.12	12.93	12.93	12.93	12.93
Fuel oil No. 3	13.84	13.84	13.53	13.03	12.62	12.62	12.37	12.12	12.93	12.93	12.93	12.93
Milwaukee, Wis.:												
Anthracite: Stove	22.10	22.10	22.10	22.10	21.60	21.60	21.60	21.60	22.10	22.10	22.10	22.10
Bituminous coal: low-volatile Stove	19.57	19.55	19.55	19.55	18.65	18.65	18.65	18.65	18.65	19.20	19.20	19.26
Coke: Nut	20.49	20.49	20.49	20.49	19.24	19.24	19.24	19.24	19.72	19.89	19.89	19.89
Heating oil:												
Fuel oil No. 2	14.08	14.10	14.10	13.30	13.30	13.30	12.00	12.00	12.40	12.40	12.40	12.40
Fuel oil No. 3	14.08	14.10	14.10	13.30	13.30	13.30	12.00	12.00	12.42	12.30	12.30	12.30
New York, N. Y.:[3]												
Anthracite:												
Stove	20.91	21.53	21.53	21.17	20.15	20.62	20.66	20.67	21.20	21.20	21.26	21.26
Buckwheat No. 1[4]	13.80	14.07	14.07	13.83	13.33	13.59	13.59	13.60	13.83	13.97	14.05	14.05
Coke: Nut	21.96	22.24	22.24	21.64	21.22	22.04	22.04	22.04	22.06	22.06	22.06	22.06
Heating oil:												
Fuel oil No. 2	12.74	12.30	11.65	10.93	10.59	10.32	10.22	10.20	11.57	11.89	11.83	12.02
Philadelphia, Pa.:												
Anthracite:												
Stove	19.95	19.95	19.95	18.89	18.89	18.89	18.95	18.95	19.22	19.50	19.84	19.84
Buckwheat No. 1	13.88	13.88	13.88	13.30	13.42	13.42	13.42	13.42	13.62	13.78	13.83	13.83
Coke: Nut	20.25	20.25	20.25	18.95	18.95	18.95	19.32	19.32	19.32	19.45	19.45	19.75
Heating oil:												
Fuel oil No. 2	12.00	12.00	12.00	11.26	11.52	10.40	10.20	10.42	11.22	11.52	11.58	11.58

Portland, Maine:												
Anthracite:												
Stove	21.54	21.54	21.54	20.24	19.94	19.94	19.94	20.60	21.10	21.50	21.50	21.50
Buckwheat No. 1	15.88	15.88	15.88	15.00	15.00	14.75	14.75	15.31	15.94	16.25	16.25	16.25
Coke: Egg	20.63	20.63	20.63	20.38	19.88	18.40	18.40	19.20	20.10	21.00	21.00	21.00
Heating oil:												
Fuel oil No. 2	12.30	12.30	12.06	11.32	11.08	11.00	10.40	10.62	11.04	11.90	11.90	11.00
Washington, D. C.:[5]												
Anthracite:												
Stove	19.42	19.62	19.62	18.62	18.62	18.84	19.04	19.60	20.07	20.30	20.30	20.30
Buckwheat No. 1	13.98	14.15	14.15	13.65	13.65	13.75	13.85	14.23	14.57	14.69	14.69	14.69
Bituminous coal: low-volatile Stove	16.45	16.70	16.70	16.35	16.35	16.35	16.35	16.84	17.21	17.21	17.21	17.21
Heating oil:												
Fuel oil No. 2	12.30	12.30	12.30	11.50	11.10	11.10	10.72	10.81	12.04	12.04	12.04	12.04

[1] Compiled from reports of Bureau of Labor Statistics. Prices are as of the 15th of each month. Data are preliminary.
[2] Includes 2 percent sales tax.
[3] Includes 1 percent sales tax.
[4] Commercial.
[5] Includes 2 percent sales tax, August-December.

EMPLOYMENT

The Pennsylvania anthracite industry employed an average of 75,377 men in 1949, only 838 fewer than in 1948. The men worked an average of 195 days; and the average annual output per man was 560 net tons, a decrease over the annual per man output of 745 tons in 1948. Of the total employees, 53 percent were employed in operations in the Wyoming region, 17 percent in the Lehigh, and 30 percent in the Schuylkill region.

Employment data, as shown in this study, do not include workers employed in "bootleg" coal-mining operations, conducted principally in the Schuylkill region. According to the Anthracite Committee, 2,928 men were working 868 "bootleg" holes in February 1950. Although these workers are not included in the employment data, the coal produced by some (442,541 net tons in 1949) was purchased by the recognized industry for preparation and shipment to market, and the coal so purchased is included in the production tables of this chapter. Complete employment data on the "bootleg" holes from which this coal was produced are not available. Therefore, the

TABLE 29.—Men employed and days worked at operations producing Pennsylvania anthracite in 1949, by regions [1]

[Includes operations of strip contractors]

Region	Average number of men employed								Average number of days plant operated	Man-days of labor	Average tons per man per day
	Underground			Surface							
	Miners and their laborers	Other	Total underground	In strip pits	In preparation plant	Other	Total surface	Grand total			
Lehigh:											
Breaker	4,922	2,886	7,808	1,762	842	2,150	4,754	12,562	190	2,382,950	[2] 2.93
Washery [3]					42	75	117	117	139	16,242	16.98
Dredge					2	4	6	6	203	1,218	18.17
Total Lehigh	4,922	2,886	7,808	1,762	886	2,229	4,877	12,685	189	2,400,410	[2] 3.03
Schuylkill:											
Breaker	7,634	4,397	12,031	4,057	2,004	3,826	9,887	21,918	182	3,995,639	[2] 3.60
Washery [3]				31	90	226	347	347	151	52,460	11.11
Dredge					129	238	367	367	227	83,262	9.94
Total Schuylkill	7,634	4,397	12,031	4,088	2,223	4,290	10,601	22,632	183	4,131,361	[2] 3.82
Wyoming:											
Breaker	20,249	10,486	30,735	1,536	1,864	5,642	9,042	39,777	205	8,139,648	2.28
Washery [3]					76	104	180	180	173	31,088	18.80
Dredge					4	3	7	7	200	1,400	10.71
Total Wyoming	20,249	10,486	30,735	1,536	1,944	5,749	9,229	39,964	204	8,172,136	2.35
Total excluding Sullivan County:											
Breaker	32,805	17,769	50,574	7,355	4,710	11,618	23,683	74,257	196	14,518,237	[2] 2.75
Washery [3]				31	208	405	644	644	155	99,790	14.46
Dredge					135	245	380	380	226	85,880	10.07
Total	32,805	17,769	50,574	7,386	5,053	12,268	24,707	75,281	195	14,703,907	[2] 2.87
Sullivan County	54	23	77		14	5	19	96	121	11,616	1.73
Grand total	32,859	17,792	50,651	7,386	5,067	12,273	24,726	75,377	195	14,715,523	[2] 2.87

[1] Men employed in "bootleg" operations excluded.
[2] Output per man per day calculated on legitimate tonnages only; "bootleg" purchases excluded.
[3] Represents washeries for which both production and employment were separately reported.

purchased coal was deducted from the total tonnage reported by the operators, and the resulting net production was then used to calculate the output per man per day. Although it is true that men employed at preparation plants of the recognized companies were engaged part time in preparing this purchased coal for market, the omission of such time will not detract materially from the validity of the per ton figure obtained. See tables 29 and 30 for details on labor statistics.

TABLE 30.—Men employed at operations producing Pennsylvania anthracite, 1948–49, by counties

[Includes operations of strip contractors]

County	1948	1949	County	1948	1949
Berks, Lancaster, Lebanon, Northampton, and Snyder [1]	148	[2] 125	Northumberland	5,977	5,747
Carbon	4,812	5,131	Schuylkill	17,261	17,975
Columbia	2,118	2,004	Sullivan	123	96
Dauphin	213	230	Susquehanna and Wayne	43	[3] 21
Lackawanna	11,707	11,520	Total	76,215	75,377
Luzerne	33,813	32,528			

[1] Counties producing dredge coal only.
[2] None in Berks in 1949.
[3] None in Wayne in 1949.

MINING METHODS AND EQUIPMENT

Mechanical Loading.—Mechanically loaded coal comprised 44 percent of the total underground production in 1949 compared with 42 percent in 1948; the quantity of anthracite loaded mechanically underground totaled 11,858,088 tons, a decline of 25 percent from 1948. The relatively flat coal seams of the Northern field are more adaptable to present-day mechanical loading methods than the sharply pitching seams in the other three fields; for this reason, 85 percent of the total tonnage mechanically loaded underground was produced in the former field and only 15 percent in the other fields. The trend in underground mechanical loading, hand loading, and stripping of Pennsylvania anthracite, 1928–49, is shown graphically in figure 2.

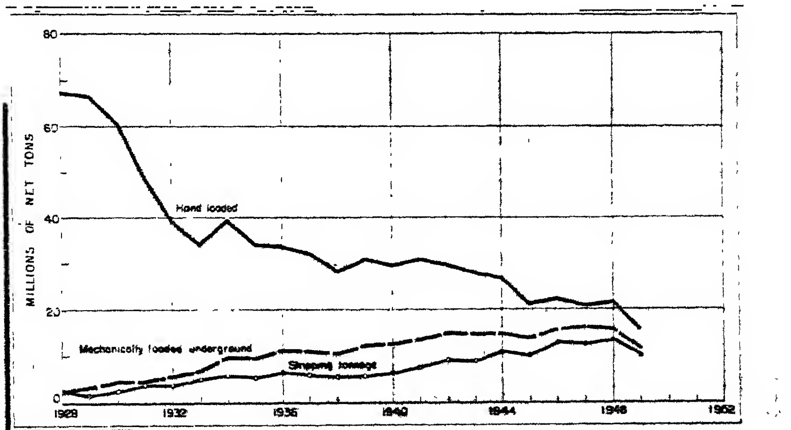

FIGURE 2.—Relative trend of mechanical loading, hand loading, and stripping of Pennsylvania anthracite, 1928–49.

TABLE 31.—Pennsylvania anthracite loaded mechanically underground, 1948–49, by fields, in net tons

Field	Scraper loaders [1]		Pit-car loaders		Hand-loaded face conveyors, all types [2]		Total mechanically loaded underground	
	1948	1949	1948	1949	1948	1949	1948	1949
Northern	2,394,262	1,740,584	87,219	100,844	11,096,707	8,202,674	13,578,188	10,044,102
Eastern Middle	114,481	67,981	101,351	64,286	406,148	264,410	621,980	396,677
Western Middle	257,074	192,225	55,161	38,470	900,116	689,488	1,212,351	920,183
Southern	16,020	29,817	15,542	30,000	298,287	437,309	329,849	497,126
Total	2,781,837	2,030,607	259,273	233,600	12,701,258	9,593,881	15,742,368	11,858,088

[1] Includes mobile loaders.
[2] Shaker chutes, etc., including those equipped with duckbills.

TABLE 32.—Pennsylvania anthracite loaded mechanically underground, 1945–49

Year	Scrapers		Mobile loaders		Conveyors and pit-car loaders [1]		Total loaded mechanically	
	Number of units	Net tons loaded	Number of units	Net tons loaded	Number of units	Net tons loaded	Number of units	Net tons loaded
1945	548	2,747,254	20	146,209	3,006	11,034,492	3,574	13,927,955
1946	564	2,714,051	27	81,545	3,233	12,823,566	3,824	15,619,162
1947	594	2,371,370	25	132,237	3,457	13,550,404	4,076	16,054,011
1948	643	2,721,180	19	60,657	3,562	12,960,531	4,224	15,742,368
1949	589	1,950,503	27	80,104	3,618	9,827,481	4,234	11,858,088

[1] Includes duckbills and other self-loading conveyors.

TABLE 33.—Relative growth of mechanical loading, hand loading, and stripping in Pennsylvania anthracite mines, 1927–49

[Mechanical loading includes coal handled on pit-car loaders and hand-loaded face conveyors]

Year	Net tons			Index numbers: 1937=100		
	Mechanical loading underground	Stripping	Hand loading	Mechanical loading underground	Stripping	Hand loading
1927	[1] 2,223,281	2,153,156	71,434,537	20	38	224
1928	[1] 2,351,074	2,422,924	67,373,788	22	43	211
1929	3,470,158	1,911,766	66,493,690	32	34	209
1930	4,467,750	2,536,288	60,458,344	42	45	190
1931	4,384,780	3,813,237	49,074,722	41	67	154
1932	5,433,340	3,980,973	38,400,820	51	70	120
1933	6,557,267	4,932,069	34,474,844	61	87	108
1934	9,284,486	5,798,138	39,290,255	87	102	123
1935	9,279,057	5,187,072	34,503,819	87	91	108
1936	10,827,946	6,203,267	33,898,560	101	109	106
1937	10,683,837	5,696,018	31,882,514	100	100	100
1938	10,151,669	5,095,341	27,990,628	95	89	88
1939	11,773,833	5,486,479	30,797,715	110	96	97
1940	12,326,000	6,352,700	29,190,837	115	112	92
1941	13,441,987	7,316,574	30,435,277	126	128	95
1942	14,741,459	9,070,933	30,495,240	138	159	96
1943	14,745,793	8,989,387	27,990,005	138	158	88
1944	14,975,146	10,953,030	26,800,270	140	192	84
1945	13,927,955	10,056,325	20,957,744	130	177	66
1946	15,619,162	12,858,930	22,465,295	146	226	70
1947	16,054,011	12,603,545	20,909,101	150	221	66
1948	15,742,368	13,352,874	21,432,923	147	234	67
1949	11,858,088	10,376,808	15,172,562	111	182	48

[1] As reported by Commonwealth of Pennsylvania, Department of Mines.

Strip-Pit Operations.—Anthracite recovered by strip-pit mining comprised 28 percent of the total fresh-mined production in 1949 compared with 27 percent in 1948; of the total 1949 strip-pit output (10,376,808 tons), 55 percent was produced in the Schuylkill region, 23 percent in the Lehigh region, and 22 percent in the Wyoming region. The high proportionate tonnage obtained by stripping in the Schuylkill and Lehigh regions is due largely to the relative ease of mining thick bed outcrops, whereas the beds in the Wyoming region are thinner, limiting the quantity of coal recoverable by strip-pit operations. Data on strip-pit mining are given in tables 34 and 35. Figure 3 shows graphically the production of anthracite from strip pits by regions, 1928–49.

TABLE 34.—Relative growth of Pennsylvania anthracite mined from strip pits, 1915, 1920, 1925, 1930, and 1944–49

	Net tons mined by stripping	Percent of fresh-mined total that was stripped	Number of men employed	Average number of days worked
1915	1,121,603	(1)	(1)	(1)
1920	2,054,441	2.5	(1)	(1)
1925	1,578,478	2.7	(1)	(1)
1930	2,536,288	3.7	(1)	(1)
1944	10,953,030	20.8	5,596	246
1945	10,056,325	22.4	5,314	238
1946	12,858,930	25.2	6,152	252
1947	12,603,545	25.4	7,264	242
1948	13,352,874	26.5	7,005	260
1949:				
Lehigh region	2,431,915	37.0	1,762	201
Schuylkill region	5,689,301	45.1	4,088	189
Wyoming region	2,255,592	12.4	1,536	219
Total [2]	10,376,808	27.7	7,386	198

[1] Data not available.
[2] No production by stripping in Sullivan County in 1949.

TABLE 35.—Power shovels and draglines used in stripping Pennsylvania anthracite, by type of power, 1947–49

Type of power	1947			1948			1949		
	Number of power shovels	Number of draglines	Total	Number of power shovels	Number of draglines	Total	Number of power shovels	Number of draglines	Total
Gasoline	75	23	98	65	8	73	66	20	86
Electric	47	46	93	54	46	100	53	45	98
Diesel	158	256	414	182	256	438	189	253	442
All other	4		4	3		3	1		1
Total	284	325	609	304	310	614	309	318	627

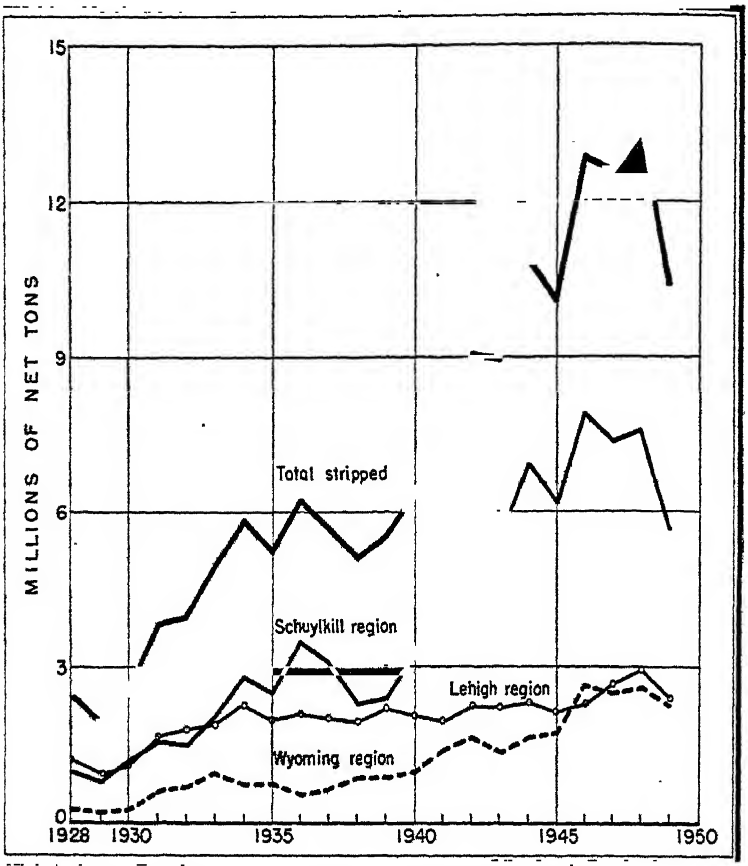

FIGURE 3.—Pennsylvania anthracite mined from strip pits, by regions, 1928–49.

Cutting Machines.—The quantity of anthracite cut by machines declined sharply in 1949 to 557,599 tons compared with 1,016,757 tons in 1948. The number of cutting machines in use in 1949 were 141 "permissible" and 12 "all other types," compared with 177 "permissible" and 28 "all other types" in 1948.

Dredge Coal.—The total quantity of anthracite recovered from the rivers and creeks draining the Pennsylvania anthracite fields declined to 865,122 tons in 1949, a decrease of 12 percent from 1948; virtually all of the coal recovered from the streams is Buckwheat No. 3 and smaller sizes used principally by electric power utilities and for other industrial purposes at points relatively near the streams from which the coal is recovered. Historical data on river-coal production are shown in table 36.

TABLE 36.—Pennsylvania anthracite produced by dredges, 1909–49, by rivers (including tributaries)

	Net tons				Value	
	Lehigh River	Schuylkill River	Susquehanna River	Total	Total	Average per ton
1909	(1)	(1)	(1)	107,788	(1)	(1)
1910	(1)	(1)	(1)	102,853	(1)	(1)
1911	(1)	(1)	(1)	106,005	(1)	(1)
1912	(1)	(1)	(1)	96,009	(1)	(1)
1913	(1)	(1)	(1)	150,064	(1)	(1)
1914	(1)	(1)	(1)	115,257	(1)	(1)
1915	(1)	(1)	(1)	138,421	$100,744	$0.73
1916	(1)	(1)	(1)	160,507	110,831	.69
1917	(1)	(1)	(1)	170,672	206,754	1.21
1918	(1)	(1)	(1)	282,930	366,565	1.30
1919	(1)	(1)	(1)	693,093	868,746	1.25
1920	(1)	(1)	(1)	740,453	862,296	1.16
1921	(1)	(1)	(1)	623,329	650,654	1.04
1922	(1)	(1)	(1)	904,108	989,709	1.09
Total, 1909–22 [2]	(1)	(1)	(1)	4,391,489	[2] 4,156,299	1.12
1923	106,092	97,254	753,022	956,368	811,065	.85
1924	80,301	74,359	670,734	825,394	681,181	.83
1925	99,614	173,639	742,455	1,015,708	929.292	.91
1926	58,544	131,654	724,566	914,764	828,398	.91
1927	85,177	127,705	758,935	971,817	794,807	.82
1928	89,304	157,449	696,648	943,401	821,530	.87
1929	87,241	133,720	495,983	716,944	626,187	.87
1930	60,219	138,236	444,836	643,291	538,268	.84
1931	33,014	90,855	334,881	458,750	379,682	.83
1932	42,091	105,990	331,969	480,050	445,799	.93
1933	51,083	106,004	381,837	538,924	452,153	.84
1934	91,346	100,873	459,961	652,180	636,038	.98
1935	78,578	73,326	438,563	590,467	517,304	.88
1936	63,327	31,660	451,688	546,684	581,679	1.06
1937	[3] 95,065	(3)	665,409	760,474	842,052	1.11
1938	[3] 123,452	(3)	447,572	571,024	570,579	1.00
1939	62,134	67,539	574,187	703,860	746,000	1.06
1940	[3] 78,947	(3)	863,997	942,944	1,097,000	1.16
1941	47,838	396,522	1,073,203	1,517,563	1,839,784	1.21
1942	9,385	268,919	1,006,729	1,285,033	1,478,719	1.15
1943	37,452	342,815	954,470	1,334,737	1,972,777	1.48
1944	40,894	494,371	837,472	1,372,737	2,084,431	1.52
1945	41,409	366,161	797,656	1,205,226	1,924,148	1.60
1946	37,441	247,757	847,196	1,132,394	2,091,324	1.85
1947	46,478	158,102	1,015,126	1,219,706	2,480,068	2.03
1948	54,284	67,871	865,849	988,004	2,291,752	2.32
1949	22,131	52,012	790,979	865,122	2,131,096	2.46
Total, 1923–49	[3] 1,722,841	[3] 4,004,802	18,425,923	24,153,566	30,593,113	1.27
Grand total	(1)	(1)	(1)	28,545,055	(1)	(1)

[1] Data not available.
[2] Figures for value cover 1915–22.
[3] Schuylkill included with Lehigh in 1937, 1938, and 1940.

TABLE 37.—Pennsylvania anthracite produced by dredges in 1949, by rivers

River (including tributaries)	Net tons	Value	
		Total	Average
Lehigh	22,131	$39,256	$1.77
Schuylkill	52,012	137,878	2.65
Susquehanna	790,979	1,953,962	2.47
Total	865,122	2,131,096	2.46

FOREIGN TRADE [4]

The decrease in shipments of Pennsylvania anthracite to Canada and European countries was largely responsible for the decline in exports from 6,675,914 tons in 1948 to 4,942,670 tons in 1949. The recession in shipments to Europe can be attributed largely to increased production of coal in Great Britain and other European countries, which enabled those countries to supply themselves with sufficient quantities of coal. The decrease in exports to Canada was caused largely by the abnormally warm weather in that country during the winter of 1949. There were no imports of anthracite into the United States in 1949.

TABLE 38.—Anthracite exported from the United States, 1948–49, by countries and customs districts, in net tons

[U. S. Department of Commerce]

Country	1948	1949	Customs district	1948	1949
North America:			North Atlantic:		
Bermuda	130	958	Maine and New Hampshire	31,942	16,943
Canada	4,931,918	3,580,568	New York	231,386	3,509
Newfoundland-Labrador	1,675	2,729	Philadelphia	1,472,406	1,289,208
Mexico	11,681	11,852	South Atlantic:		
West Indies:			Maryland	10,261	164
British	26	72	Virginia	20	62
Cuba	3,522		Gulf coast:		
South America:			Florida	6	10
Brazil	50		New Orleans	6	12
Chile	78	70	Mexican border:		
Venezuela		235	Arizona	47	51
Other South America		20	El Paso	8	17
Europe:			Laredo		24
Belgium-Luxembourg	209,400		Pacific coast:		
France	1,425,322	1,051,313	Alaska	10	
Ireland	20		San Diego	3	
Italy	53,386	29,772	Washington	16,433	9
Netherlands	4,839	155,458	Northern border:		
Yugoslavia		6,548	Buffalo	2,968,582	2,257,022
Other Europe		123	Dakota	4,412	2,945
Asia:			Duluth and Superior	7,984	11,644
China	18		Michigan	30,037	3,724
Israel		14,720	Montana and Idaho	4,296	
Japan	30,820	88,227	Ohio	12,523	14,365
Other Asia	168	5	Rochester	126,683	90,901
Africa:			St. Lawrence	1,725,344	1,161,805
Belgian Congo	2,859		Vermont	2,705	2,028
Other Africa	2				
Total	6,675,914	4,942,670	Total	[1] 6,675,914	[1] 4,942,670

[1] Includes shipments on vessels operated by the U. S. Army or Navy as follows: 1948—30,820 tons; 1949—88,227 tons.

[4] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 39.—Anthracite imported for consumption in the United States, 1947–49,[1] by countries and customs districts, in net tons

[U. S. Department of Commerce]

Country	1947	1948	Customs district	1947	1948
Argentina		1	Laredo	50	
Canada	10,293	144	Maryland		800
Chile	7		Montana and Idaho	10,293	
Mexico	50		New York	7	1
United Kingdom		800	Washington		144
Total	10,350	945	Total	10,350	945

[1] No imports during 1949.

CANADA

The production of coal in Canada continued to rise and in 1949 totaled 19,089,235 net tons, an increase of 20 and 3 percent, respectively, over 1947 and 1948. All of the Provinces except Nova Scotia showed substantial increases in 1949 over 1948; Nova Scotia reported a decline of 4 percent. Details on coal and coke statistics for Canada are shown in tables 40 and 41.

TABLE 40.—Coal and coke production and foreign trade of Canada, 1948–49, in thousands of net tons [1]

	Coal								Coke from coal	
	Anthracite		Bituminous and subbituminous		Lignite		Total			
	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949
Production			16,861	17,224	1,589	1,865	18,450	19,089	3,946	3,867
Imports	5,143	4,080	25,912	15,965			31,055	20,045	562	445
Exports			1,263	425	10	7	1,273	432	167	273
Available for consumption	5,143	4,080	41,510	32,764	1,579	1,858	48,232	38,702	4,341	4,039

[1] Monthly Coal and Coke Statistics for Canada, December 1949.

TABLE 41.—Canadian coal production, 1948–49, by Provinces and by kinds, in net tons [1]

	Bituminous		Subbituminous		Lignite		Total	
	1948	1949	1948	1949	1948	1949	1948	1949
Alberta	4,934,458	5,493,003	3,188,797	3,120,212			8,123,255	8,613,215
British Columbia	1,784,135	1,902,814					1,784,135	1,902,814
New Brunswick	522,136	526,878					522,136	526,878
Nova Scotia	6,430,991	6,181,307					6,430,991	6,181,307
Saskatchewan					1,589,172	1,865,021	1,589,172	1,865,021
Total	13,671,720	14,104,002	3,188,797	3,120,212	1,589,172	1,865,021	18,449,689	19,089,235

[1] Monthly Coal and Coke Statistics for Canada, December 1949.

WORLD PRODUCTION

World production of anthracite declined slightly in 1949 from 1948. The decreased production of the United States was largely responsible for the decline in world output, inasmuch as a number of countries increased production substantially. Available data on world production by countries, for 1944–49 are given in table 42.

TABLE 42.—World production of anthracite in metric tons, 1944–49 [1]

[Compiled by Pauline Roberts]

Country [1]	1944	1945	1946	1947	1948	1949
China [2]	(3)	1,451,000	757,114	878,062	(3)	(3)
France	4,964,000	6,611,458	8,313,230	8,041,874	(3)	(3)
French Indochina	499,400	217,700	261,696	247,777	349,000	376,800
French Morocco	134,400	178,600	221,750	268,500	290,300	341,417
Ireland	130,198	123,468	122,886	121,915	[4] 88,400	(3)
Italy	59,028	61,256	104,507	114,580	86,611	75,252
Japan	(3)	(3)	444,000	648,000	840,000	772,000
Korea:						
North	4,530,262	673,796	[4] 830,000	[4] 1,340,000	(3)	(3)
South			241,770	475,190	699,234	1,038,680
New Zealand	(3)	2,571	2,308	1,632	1,773	1,915
Peru	14,545	36,848	82,089	82,045	45,969	60,000
Portugal [5]	389,638	436,117	379,526	370,147	386,763	443,456
Rumania	12,000	17,000	15,994	23,779	(3)	35,000
Spain	1,516,035	1,529,532	1,457,529	1,411,352	1,462,736	1,439,217
Switzerland	51,232	101,993	74,544	15,066	(3)	(3)
United Kingdom	3,652,881	3,213,405	3,547,742	(3)	(3)	(3)
United States (Pennsylvania)	57,788,602	49,834,944	54,890,625	51,881,632	51,836,218	38,738,150
Total (estimate)	114,070,000	106,630,000	116,755,000	118,930,000	128,520,000	125,571,000

[1] In addition to countries listed, Belgium, Bulgaria, Germany, and U. S. S. R. produce anthracite, but data of output are not available. Estimates by author of chapter included in total.
[2] Excludes Kwantung Peninsula.
[3] Data not available; estimate by author of chapter included in total.
[4] Estimate.
[5] Quality in doubt; may be bituminous.

Cobalt

By Hubert W. Davis

GENERAL SUMMARY

CONSUMPTION of cobalt in the United States continued at a high level in 1949 but was 6 percent less than the record established in 1948, when it exceeded 5,000,000 pounds for the first time. Usage of cobalt for cobalt-base high-temperature alloys and cemented carbides was greater in 1949 than in 1948, but these gains were more than offset by smaller use of cobalt in magnet alloys, high-speed and other steels, alloy hard-facing rods and materials, ground-coat frit for porcelain enamel, and pigments. Despite the high rate of use of cobalt in 1949, supplies substantially exceeded industry requirements, chiefly because of the record output of 4,350 metric tons from Belgian Congo ores.

Sales of cobalt metal in the United States were 12 percent smaller in 1949 than in 1948; sales to industry were 11 percent less and those to the National Stock Pile 13 percent smaller. The metal was supplied chiefly by imports but partly by production in the United States. Imports of metal in 1949 increased 6 percent over 1948, and domestic production of metal gained 2 percent. Suppliers' stocks of metal in the United States increased 19 percent.

The demand for cobalt oxide declined substantially in 1949, chiefly because of smaller use in ground-coat frit for porcelain enamel and in pigments; as a consequence, output of oxide in the United States and imports dropped 20 and 55 percent, respectively.

Production and shipments of cobalt hydrate and salts were larger in 1949 than in 1948, but those of driers were smaller.

The bulk of the cobalt metal, oxide, hydrate, and other cobalt products sold in the United States is made from crude cobalt (alloy) produced in Belgian Congo. Imports of alloy from Belgian Congo were 24 percent less in 1949 than in 1948. Some of the cobalt products sold are made from domestic and Canadian ores. Output of domestic ore was 24 percent smaller than in 1948, and imports of Canadian ore by refiners were down 91 percent. Consumption of cobalt alloy and ore was 4 percent smaller.

Effective April 1, 1949, the price of cobalt in metal and oxide was advanced 15 cents a pound.

The Reduction & Refining Co., Kenilworth, N. J., began refining Government-held ore and subgrade metal late in 1949.

The extraction of cobalt and its uses were described.[1]

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[1] Dennis, W. H., The Metallurgy of Cobalt: Mining Mag. (London), vol. 81, No. 3, September 1949, pp. 144–146; vol. 81, No. 4, October 1949, pp. 215–218.

DOMESTIC PRODUCTION

Mine Production.—Despite the fact that the United States is the largest consumer of cobalt in the world, only a small part of its requirements has been furnished by domestic ore, as is evident from the next table, which shows production and shipments through 1949.

Cobalt ore produced and shipped in the United States through 1949

Year	Produced		Shipped from mines	
	Gross weight (short tons)	Cobalt content (pounds)	Gross weight (short tons)	Cobalt content (pounds)
Previous to 1921 (partly estimated)	(1)	730,000	(1)	730,000
1921–32 (partly estimated)	93	9,300	41	5,000
1933	20	1,160		
1934	31	2,009		
1935	23	1,995		
1936	6	526		
1937	24	3,023		
1938	16	1,075		
1939	27	1,705		
1940	5,048	133,800	4,500	127,000
1941	19,127	505,377	20,031	521,627
1942	26,241	735,335	23,741	661,657
1943	27,103	732,098	28,541	763,772
1944	18,407	828,515	17,539	556,687
1945	19,770	1,099,654	17,528	1,281,681
1946	15,620	518,378	15,542	506,884
1947	22,348	645,295	23,442	676,612
1948	25,721	687,464	22,173	580,703
1949	19,599	521,656	25,175	673,773
Total	(1)	7,158,365	(1)	7,085,396

[1] Data not available.

Production of cobalt ore in the United States in 1949 was 24 percent less than in 1948, but shipments were 16 percent more.

The Bethlehem Steel Co. was the only producer of commercial cobalt ore in the United States in 1949. The cobalt-bearing material (averaging 1.3 percent cobalt in 1949) is contained in the sulfides that accompany the magnetite mined at Cornwall, Pa. The cobalt-bearing material is shipped to the Pyrites Co., Wilmington, Del., where it is processed to metal and other cobalt products.

The Sullivan Mining Co., Kellogg, Idaho, continued to recover cobalt at its electrolytic zinc plant in 1949 but, as in previous years, made no shipments. In 1949 it recovered 126 short tons of residues containing 10,338 pounds of cobalt.

Underground development was continued in 1949 at the Blackbird mine near Forney, Idaho, by the Calera Mining Co., a wholly owned subsidiary of the Howe Sound Co. Underground development consisted of preproduction drifting and raising. Surface construction comprised dormitories and houses at the townsite and erection of several buildings at the industrial site. A complete water and sewage system was installed. Some excavation work was done for the

mill. The ore carries copper and gold, as well as cobalt. According to the Howe Sound Co.:[2]

Research work in connection with milling the complex cobalt ore, and refining the cobalt product, continued. Work on the refining process, which has been under study for some time, was concluded. Additional research has, however, been started on an entirely new process which, if adaptable, may be more economical than the one which has been completely developed. Within six months it is anticipated that full information in regard to the applicability of this alternate process will be available.

Refinery Production.—Consumption by refiners or processors of cobalt contained in alloy and ore was 2,607,281 pounds in 1949, a decrease of 4 percent from 1948. However, usage of cobalt intermediates by refiners or processors was 2 percent greater. Of the alloy and ore consumed in 1949, much the greater part was utilized in making cobalt metal. The remainder of the alloy and ore and all of the other cobalt raw materials were used in manufacturing the cobalt products shown in the accompanying table.

Cobalt consumed[1] by refiners or processors in the United States, 1945–49, in pounds of contained cobalt

Cobalt material	1945	1946	1947	1948	1949
Alloy and ore	4,808,825	2,009,018	2,672,991	2,715,605	2,607,281
Fines and granules	453,538	499,737	528,544	393,726	422,493
Rondelles	64,872	148,197	128,937	107,520	95,759
Hydrate	133,831	128,740	152,102	150,826	129,444
Carbonate	18,460	19,243	6,904	4,606	2,664
Other	----------	----------	----------	----------	17,565

[1] The fines, granules, rondelles, hydrate, and carbonate consumed originated from alloy and ore; therefore, combining alloy and ore with these materials would result in duplication.

Specified cobalt products[1] produced and shipped in the United States, 1948–49, in pounds

Product	Production		Shipments	
	Gross weight	Cobalt content	Gross weight	Cobalt content
1948				
Oxide	547,393	385,774	540,270	380,462
Hydrate	399,110	154,049	420,245	162,769
Salts:				
Acetate	165,095	38,634	180,695	42,331
Carbonate	117,212	53,140	134,309	61,677
Sulfate	385,949	80,407	479,394	98,060
Other	30,237	8,062	36,306	8,173
Driers	9,869,505	590,684	10,008,193	597,883
1949				
Oxide	439,150	310,521	387,654	274,724
Hydrate	419,248	167,033	410,432	165,682
Salts:				
Acetate	159,426	37,272	154,382	36,132
Carbonate	135,239	62,015	141,792	65,573
Sulfate	496,799	103,922	506,728	106,172
Other	24,577	5,786	28,716	7,114
Driers	8,301,277	490,360	8,234,863	491,395

[1] In addition, cobalt metal (rondelles, granules, fines, and powder) was produced, but the Bureau of Mines is not at liberty to publish figures on production and shipments.

[2] Howe Sound Co., Annual Report: 1949, p. 5.

CONSUMPTION

Consumption of cobalt by industrial consumers continued at a high rate in 1949 but was 6 percent under the record established in 1948; it was 4,701,926 pounds in 1949. Magnet alloys continued to be the largest single use for cobalt and accounted for 26 percent of the total quantity consumed in 1949; usage for this purpose, however, was 8 percent less than in 1948. The development of two permanent magnet materials—Alnico 7 and Alnico 5 DG—was announced in 1949. Alnico 7 was designed primarily for all applications where a high demagnetization force is present, particularly in motors, generators, and air-gap devices. Alnico 5 DG, which was in the sampling stage, was developed for improved quality at an increased price for general use. Typical applications for Alnico 5 DG are loudspeakers and magnetic assemblies which require a high field strength and which are magnetized after final assembly, such as holding magnet assemblies, magnetic chucks, and radar assemblies. The more recent applications for Alnico magnets are primarily centered around the television industry. However, the communication, magnetic separator, and novelty fields of application continue to use much the greater share of magnets produced. A permanent Alnico magnet designed to serve as a clamp for the ground cable on electric welders is now being marketed.[3] The casting of alloys for permanent magnets has been discussed.[4]

The second-largest use for cobalt was for cast cobalt-chromium-tungsten-molybdenum alloys, which accounted for 20 percent of the total quantity consumed in 1949; moreover, usage for this purpose was 12 percent greater than in 1948. An alloy suitable for use at high temperatures, which contains 5 to 7 percent cobalt, is the subject of

Cobalt consumed in the United States, 1946–49, by uses, in pounds of cobalt

Use	1946	1947	1948	1949
Metallic:				
High-speed steel	224,049	223,148	289,391	283,496
Other steel	201,949	386,354	503,082	472,193
Permanent-magnet alloys	1,463,539	1,016,147	1,352,371	1,194,920
Soft-magnetic alloys				42,965
Cast cobalt-chromium-tungsten-molybdenum alloys	526,504	642,452	826,329	928,528
Alloy hard-facing rods and materials	53,874	71,545	116,313	82,965
Cemented carbides	45,100	[1] 51,917	[1] 85,314	118,522
Other metallic	81,988	99,476	115,255	116,344
Total metallic	2,597,003	[1] 2,491,039	[1] 3,288,055	3,239,933
Nonmetallic (exclusive of salts and driers):				
Ground-coat frit	412,766	607,316	613,745	424,051
Pigments	170,662	207,928	232,725	188,606
Other nonmetallic	39,596	51,439	66,699	84,336
Total nonmetallic	623,024	866,683	913,169	696,993
Salts and driers: Lacquers, varnishes, paints, inks, pigments, enamels, glazes, feed, electroplating, etc. (estimate)	885,000	797,000	818,000	765,000
Grand total	4,105,027	[1] 4,154,722	[1] 5,019,224	4,701,926

[1] Revised figure.

[3] Materials & Methods, vol. 30, No. 6, December 1949, p. 114.

[4] Dickinson, T. A., Casting Alloys for Permanent Magnets: Steel, vol. 126, No. 2, Jan. 9, 1950, pp 48–50, 74.

United States Patent 2,460,817. Cobalt-base alloys containing 80 percent cobalt are the subject of United States Patent 2,469,715.

A substantial gain in the use of cobalt in cemented carbides was recorded in 1949. A comprehensive article on cemented carbides was made availabe.[5]

Utilization of cobalt in ground-coat frit for porcelain enamel and in pigments reversed upward trends that have persisted since 1942; and less cobalt was also used in high-speed and other steels and in alloy hard-facing rods and materials.

An eight-metal alloy—Octanium—of which cobalt is a component, was developed for use in the nib (point) of fountain pens.

PRICES

Effective April 1, 1949, the price of cobalt metal (97–99 percent, in kegs of 550 pounds) was raised to $1.80 a pound delivered east of Chicago; and for quantities under 100 pounds it was increased to $1.87 a pound. Metallurgical-grade oxide was also raised to $1.80 a pound of contained cobalt, f. o. b. Niagara Falls, N. Y., and ceramic-grade oxide to $1.38 a pound (gross weight) east of the Mississippi River. The former prices, which had been in effect since July 1, 1947, were $1.65, $1.72, $1.65, and $1.27 a pound, respectively.

FOREIGN TRADE[6]

Imports.—Imports of cobalt into the United States in 1949 were 15 percent smaller than in 1948, which, however, was an all-time

Cobalt imported for consumption in the United States, 1945–49, by classes

[U. S. Department of Commerce]

Year	Alloy [1] (pounds)		Ore		
			Pounds		Value
	Gross weight	Cobalt content	Gross weight	Cobalt content	
1945	8,397,145	3,616,000	859,940	109,112	$91,654
1946	1,648,506	717,337	[2] 657,787	[2] 73,892	[2] 59,861
1947	3,751,452	1,640,952	751,438	77,721	85,920
1948	4,879,413	2,179,473	8,167,545	870,519	847,659
1949	3,691,051	1,657,788	109,009	11,965	9,244

Year	Metal		Oxide		Salts and other compounds	
	Pounds	Value	Pounds (gross weight)	Value	Pounds (gross weight)	Value
1945	946,475	$1,582,870	120,672	$215,563	224	$760
1946	1,935,582	2,749,326	1,074,630	1,450,296	350	778
1947	[3] 6,035,153	[3] 7,994,347	752,150	753,916	530	1,856
1948	[3] 5,266,521	7,743,879	790,300	828,667	1,374	4,514
1949	5,588,327	9,026,895	360,318	384,879	258	1,167

[1] Reported by importer to Bureau of Mines; not separately classified by U. S. Department of Commerce. Value not available.

[2] Data adjusted by Bureau of Mines to exclude alloy.

[3] Adjusted by Bureau of Mines.

[5] Rose, Kenneth, Cemented Carbides: Materials & Methods, vol. 29, No. 2, February [illegible], pp. [illegible].

[6] Figures on imports and exports (unless otherwise indicated) compiled by M. B. [illegible], of the Bureau of Mines, from records of the U. S. Department of Commerce.

record. Belgian Congo continued to be the chief source of imports; in 1949 it supplied 3,396,590 pounds of metal and 3,691,051 pounds of alloy containing 1,657,788 pounds of cobalt. Belgium supplied 2,180,650 pounds of metal and 360,150 pounds of oxide containing 255,160 pounds of cobalt; both the metal and oxide were produced from Belgian Congo alloy. Canada supplied 168 pounds (gross weight) of oxide and 106,690 pounds of ore containing 11,698 pounds of cobalt and Denmark 2,319 pounds of ore containing 267 pounds of cobalt. The United Kingdom supplied 64 pounds of metal and 359 pounds (gross weight) of salts and compounds. Finland supplied 11,023 pounds of metal. The imports from Finland were the first since 1940.

The accompanying historical table shows imports of cobalt for 1923–49, by classes. Corresponding figures for earlier years are not available. However, imports of cobalt apparently did not exceed 500,000 pounds annually until 1926; from that year they increased steadily through 1929, when they reached 1,212,000 pounds. Imports declined abruptly during 1930–32, dropping to 303,000 pounds in 1932. Since 1933, however, imports of cobalt have increased almost steadily and reached an all-time high of 8,821,000 pounds in 1948.

During the 27 years 1923–49, receipts of metal comprised about 43 percent of the cobalt imports, most of which was supplied by Belgium and Belgian Congo. Smaller quantities of metal have been received from Austria, Canada, Finland, France, Germany, Japan, Sweden,

Cobalt imported for consumption in the United States, 1923–49, in pounds

Year	Gross weight					Total	
	Alloy	Ore	Metal	Oxide	Sulfate and other compounds	Gross weight	Cobalt content (estimated)
1923	----------	58,719	225,639	258,574	45,644	588,576	426,000
1924	----------	28,786	118,952	226,703	797	375,238	283,000
1925	----------	34,782	198,669	287,265	13,256	533,972	408,000
1926	----------	154,468	387,076	333,132	37,342	912,018	642,000
1927	----------	60,382	407,198	369,747	55,127	892,454	680,000
1928	----------	107,498	535,817	364,154	68,281	1,075,750	819,000
1929	----------	434,443	806,640	475,928	64,782	1,781,793	1,212,000
1930	----------	199,642	460,251	425,881	55,303	1,141,077	794,000
1931	----------	83,895	164,967	321,891	46,317	617,070	410,000
1932	----------	27,193	123,112	225,896	92,098	468,299	303,000
1933	----------	556,119	281,713	568,057	99,231	1,505,120	769,000
1934	439,476	748,513	506,119	328,730	43,787	2,066,625	1,000,000
1935	378,848	419,110	563,866	557,083	80,554	1,999,461	1,167,000
1936	----------	1,039,760	883,377	813,642	46,658	2,783,437	1,580,000
1937	----------	587,499	1,073,129	842,847	56,585	2,560,060	1,734,000
1938	----------	449,984	938,476	373,215	41,867	1,803,542	1,249,000
1939	----------	611,083	2,130,296	680,644	76,664	3,498,687	2,665,000
1940	7,843,828	2,653,891	130,321	756,759	11,468	11,396,267	4,200,000
1941 [1]	9,970,589	2,443,725	554,030	38,002	4,980	[1] 13,011,326	[1] 4,328,000
1942	10,313,867	834,797	148,304	----------	200	11,297,168	4,280,000
1943	10,110,879	10,556,042	266,670	58,928	56	20,992,575	5,626,000
1944	8,500,516	473,529	73,088	225,609	115	9,272,857	3,798,000
1945	8,397,145	859,940	946,475	120,672	224	10,324,456	4,615,000
1946	1,648,595	657,787	1,935,582	1,074,630	350	5,316,944	3,451,000
1947	3,751,452	751,438	6,035,153	752,150	530	11,290,723	8,206,000
1948	4,879,413	8,167,545	5,266,521	790,300	1,374	19,105,153	8,821,000
1949	3,691,051	109,009	5,588,327	360,318	359	9,749,064	7,458,000

[1] In addition to classes shown, 4,796,000 pounds of Burmese speiss containing 335,721 pounds of cobalt were imported.

and United Kingdom. Imports of alloy represented the second-largest quantity (40 percent), and virtually all was from Belgian Congo. About 12 percent of the imports of cobalt have been in the form of oxide, chiefly from Belgium. Substantial quantities of oxide have also been received from Germany and Canada, and smaller quantities from Australia, Finland, and France. Receipts of cobalt ore have accounted for about 5 percent of the total imports; Canada has been the largest source and most of the remainder came from Australia and French Morocco.

Exports.—Exports of cobalt from the United States are small; 164,868 pounds of metal (including scrap) valued at $55,933 were exported in 1949. Some oxide, salts, and driers are also exported, but the figures are not separately recorded by the United States Department of Commerce.

Tariff.—The duty on cobalt oxide continued to be 10 cents a pound, sulfate 5 cents a pound, linoleate 10 cents, and other salts and compounds 30 percent ad valorem. Cobalt metal and ore entered the United States duty free.

WORLD REVIEW

Virtually all cobalt is found associated with other metals, such as copper, nickel, iron, arsenic, lead, zinc, manganese, silver, and gold. Belgian Congo and Northern Rhodesia, where cobalt occurs associated with copper, have been the chief producing countries in recent years, followed by the United States, Canada, and French Morocco. These five countries have contributed about 95 percent of the world output of cobalt in recent years. Iron pyrites from Finland, Germany, Greece, Italy, Norway, Spain, and Sweden contains cobalt, some of which is recovered. Although the quantities of cobalt present in iron pyrites are generally very small—often only 0.05 percent—and its

World mine production of cobalt, by countries, 1940–49, in metric tons of contained cobalt [1]

[Compiled by Berenice B. Mitchell]

Country [1]	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
Australia	12	13	14	15	9	10	11	12	15	(2)
Belgian Congo	2,301	2,256	1,656	2,061	1,877	2,800	2,156	3,563	4,3[illegible]	[illegible]
Bolivia (exports)	2	2	(3)	(3)						(2)
Burma	218	73								
Canada [4]	360	119	38	80	16	49	34	300	701	276
Chile	(3)	2	(3)	3	5	1				(2)
Finland	(2)	(2)	96	79	86	84	101	50	(2)	(2)
Italy	89	81	60	27	7	6	(2)	(2)	(2)	(2)
Japan		(3)	1	3	15	11	7	6	(2)	(2)
Morocco, French	330	65	3	216	243	108	200	370	278	209
Northern Rhodesia [5]	1,223	650	914	943	978	874	552	428	367	402
Sweden						9				(2)
United States (shipments)	58	237	300	346	253	381	230	307	263	306
Total (estimate)	5,000	4,000	3,500	4,200	3,900	4,700	3,500	5,300	6,200	5,900

[1] In addition to countries listed, Brazil, China, Germany, and Spain produce cobalt, but production data are not available. Estimate by author of chapter included in total.
[2] Data not available; estimate by author of chapter included in total.
[3] Less than 1 ton.
[4] Figures comprise Canadian ore processed in Canada and exported (irrespective of year when mined), plus cobalt content of oxide made at Port Colborne from copper-nickel ore. However, figures exclude the cobalt recovered at Clydach (Wales) from Canadian nickel-copper ores, for which estimate by author of chapter has been included in world total.
[5] Year ended June 30 of year stated.

recovery is only 50 to 60 percent, the very large tonnage treated during and preceding the war contributed greatly to the cobalt production in Germany. It is reported[7] that about 10 tons of cobalt concentrates are obtained from 100,000 tons of cinder. A complete record of output of cobalt from iron pyrites is lacking.

Australia.—The only production of cobalt in Australia for many years has been obtained from the lead-zinc-silver ores of Broken Hill, New South Wales. The cobalt is recovered at Risdon, where it is converted into metal, oxide, and sulfate containing about 11 to 15 metric tons of cobalt annually.

Belgian Congo.—The world's premier source of cobalt continues to be Belgian Congo, where the Union Minière du Haut-Katanga is the sole producer. Output was 4,350 metric tons in 1949, a new record. Production of cobalt in Belgian Congo was begun in 1924, and since that year output has increased almost without interruption and total production through 1949 has been 36,706 metric tons.

Production of cobalt in Belgian Congo, 1924–49, in metric tons of contained cobalt

Year	Metric tons	Year	Metric tons
1924	273	1938	1,532
1925	192	1939	1,080
1926	360	1940	2,301
1927	558	1941	2,256
1928	450	1942	1,656
1929	700	1943	2,061
1930	700	1944	1,877
1931	370	1945	2,800
1932	335	1946	2,150
1933	618	1947	3,563
1934		1948	4,322
1935	17	1949	4,350
1936	685		
1937	1,500	Total	36,706

The Union Minière du Haut-Katanga has a cobalt mine and a cobalt-concentrating plant at Kabolela and a cobalt mine and ore-treatment plant at Kamoto. Its Ruashi mine near Elisabethville is planned to be reopened. At Jadotville the company has six single-phase electric furnaces (total monthly capacity, about 300 tons) for smelting cobalt-bearing ores and slags. The cobaltiferous red alloy from the electric furnaces is refined in two rotary furnaces; and the resultant crude cobalt, which is cast into ingots, is shipped chiefly to company refining plants at Niagara Falls, N. Y., and Oolen, Belgium, for processing the crude cobalt to metal, oxide, salts, and driers. The solutions used in the electrolytic copper plants contain cobalt, recovered by precipitation. The precipitates are treated by electrolysis in a refining plant (also at Jadotville) capable of producing about 225 tons a month of high-purity granules. The total refining capacity of the company plants at Niagara Falls, N. Y., Oolen, Belgium, and Jadotville, Belgian Congo, is about 7,500 tons annually. The program for expanding the capacity of the Kolwezi and Kipushi concentrators and the electrolytic plant (copper and cobalt) at Jadotville-Shituru continued in 1949. The first of the two new power stations at Centrale Bia was completed. On the basis of a rate of production of 4,000 metric tons annually, the company reported developed re-

[7] Dennis, W. H., Recovery of Nonferrous Metals from Pyrite: Mine and Quarry Eng. (London), vol. 13, No. 12, December 1947, pp. 358-362.

serves of cobalt adequate for 40 to 50 years, and it anticipates that these reserves will increase as a result of further development of its copper deposits.

Canada.—Production of cobalt in Canada is measured by the quantities of Canadian ores processed and exported, irrespective of the year when mined, plus the cobalt content of oxide made by the International Nickel Co. of Canada, Ltd., at Port Colborne, Ontario. Canadian production figures, however, do not include the cobalt recovered by the Mond Nickel Co. at its Clydach (Wales) nickel refinery from the nickel-copper ores of the Sudbury district.

According to the Dominion Bureau of Statistics, production of cobalt (content) in Canada was 613,600 pounds in 1949 compared with 1,544,852 pounds in 1948. The major portion of the output credited to Canada in 1948 came from accumulations during the war years rather than from ores mined in 1948. Cobalt ore was discovered in northern Ontario in 1903; production began in 1904. The name "Cobalt" was given to the district that for many years thereafter furnished the greater part of the world's supply. Recovery of cobalt from the copper-nickel ore of the Sudbury district was begun in 1947. Production of cobalt in Canada from 1904 through 1949 has been as follows.

Production of cobalt in Canada, 1904–49, in short tons of contained cobalt [1]

[Dominion Bureau of Statistics]

Year	Short tons	Year	Short tons
1904	16	1928	478
1905	118	1929	465
1906	321	1930	347
1907	739	1931	261
1908	1,224	1932	245
1909	1,533	1933	233
1910	1,098	1934	297
1911	852	1935	341
1912	934	1936	444
1913	821	1937	254
1914	351	1938	230
1915	206	1939	366
1916	400	1940	307
1917	337	1941	132
1918	330	1942	42
1919	298	1943	88
1920	283	1944	18
1921	126	1945	55
1922	285	1946	[illegible]
1923	444	1947	[illegible]
1924	474	1948	772
1925	558	1949	307
1926	333		
1927	440	Total	18,665

[1] Excludes cobalt recovered at Clydach (Wales) from Canadian copper-nickel ores.

The International Nickel Co. of Canada, Ltd., at its Canadian nickel refinery, continued the recovery of cobalt as oxide from the nickel-copper ores of the Sudbury district. Output of cobalt in oxide was reported as 15 short tons monthly in 1948. It was reported that recovery of cobalt would be greater in 1950.

Falconbridge Nickel Mines, Ltd., continued construction, at its nickel refinery at Kristiansand, Norway, of a plant to produce cobalt oxide and electrolytic cobalt, which will be made from the cobalt recovered from the matte produced from Sudbury nickel-copper ores.

In the cobalt area of northern Ontario, the Cobalt Chemical &

Refinery Co. (successor to Silanco Mining & Refining Co., Ltd.) was the chief producer. It operated the Colonial concentrator, which treated ore from the Beaver mine. The construction of a smelter, begun in 1945 by the Silanco Mining & Refining Co., Ltd., was completed in 1949. It is reported that the New Cross Chemical Co. plans to construct a plant adjacent to the smelter of Cobalt Chemical & Refinery Co. to produce salts, oxides, and other cobalt products.

French Morocco.—Production of cobalt ore in French Morocco was 1,739 metric tons containing 209 tons of cobalt in 1949 compared with 2,094 tons containing 278 tons of cobalt in 1948. La Société Minière de Bou-Azzer et du Graara, Casablanca, is the sole producer. The ore, which also contains nickel, gold, and silver, is shipped to Belgium for processing to oxide and speiss, which are exported to France, where the speiss is refined to metal.

Germany (Bizonia).—Production of cobalt derived from pyrites residues in Bizonia was 80 to 90 metric tons in 1948.[8]

Northern Rhodesia.—The second-largest producer of cobalt in the world continues to be Northern Rhodesia, where the Rhokana Corp., which has been producing cobalt since 1933, is the sole producer. The 4-year downward trend in production was reversed in 1949, when the output of alloy was 1,171 short tons containing 443 tons of cobalt in the year ended June 30, compared with 1,081 tons containing 405 tons in 1948. Laboratory and pilot-plant investigations on the production of electrolytic cobalt from a flotation concentrate recovered by the Rhokana Corp. have been described.[9] As a consequence of new methods for recovering cobalt from copper ores which have low cobalt content and of the authorization of $550,000 by the Economic Cooperation Administration to finance American equipment for expanding the plant of the Rhokana Corp., it is expected that Northern Rhodesian production of cobalt will increase substantially by 1951.

Production of cobalt in Northern Rhodesia, 1933–49, in short tons

Year ended June 30	Alloy	Cobalt contained	Year ended June 30	Alloy	Cobalt contained
1933	33	18	1943	2,582	1,040
1934	988	509	1944	2,662	1,078
1935	1,130	586	1945	2,415	963
1936	1,080	523	1946	1,527	609
1937	1,274	637	1947	1,225	463
1938	2,854	1,183	1948	1,081	405
1939	4,511	1,761	1949	1,171	443
1940	3,291	1,348			
1941	1,785	717	Total	32,093	13,291
1942	2,484	1,008			

[8] Mining World, vol. 11, No. 11, October 1949, p. 42.

[9] Talbot, H. L., and Hepker, H. N., Investigations on the Production of Electrolytic Cobalt from a Copper-Cobalt Flotation Concentrate: Bull. Inst. Mining and Metallurgy (London), No. 514, September 1949, pp. 1–19.

Coke and Coal Chemicals

By J. A. DeCarlo, J. A. Corgan, and Maxine M. Otero

GENERAL SUMMARY

PRODUCTION of oven and beehive coke in the United States in 1949 totaled 63,637,429 net tons, a decline of 15 percent from the record output of 1948. The decline was due largely to (1) complete work stoppages for various periods in both the steel and bituminous-coal industries beginning in September, (2) initiation of a 3-day workweek at bituminous-coal mines in July, and (3) slackening in steel demand in the second quarter of the year. Oven-coke production started to decline slightly during the latter half of March and in October fell to the lowest figure since May 1946 because the steel strike, beginning at midnight September 31, forced virtually all "furnace" oven-coke plants to bank their ovens until a new management-labor contract was negotiated about the middle of November. Although production increased rapidly thereafter, output for the year dropped 12 percent from 1948. Beehive-coke operations were affected to an even greater extent, as the 3-day workweek, beginning in July, caused virtually all of the active plants to suspend operation for the rest of the year, and production dropped 48 percent.

A significant development in 1949 was the substantial increase in the proportion of washed coal charged into ovens. The necessity of using more low-grade coals for the manufacture of metallurgical coke has made it imperative to clean the inferior coals. Thus, in 1949, more than 38 percent of the bituminous coal carbonized in slot-type ovens and 20 percent of the coal for beehive ovens was washed, compared with 29 and 18 percent, respectively, in 1948. The influence of washing coal on coke properties and on gas and coal-chemical materials yield was reflected in the improvement in fuel efficiency of blast furnaces and the increase in yields of gas, tar, crude light oil, and ammonia. The yield of coke per ton of coal charged, however, declined slightly from the 1948 figure.

Cost of coal, the principal item of expense in the manufacture of coke and naturally influencing coke prices, continued to advance in 1949 because of increases in mining, preparation, and transportation costs. The average cost of coal delivered to oven-coke plants rose $0.39 per ton or 5 percent to $8.52, a new peak. Coal costs for beehive ovens also soared to a new level, rising $0.31 per ton or 6 percent over the 1948 figure. These increases resulted in higher prices on coke, and average receipts per ton of oven coke sold (merchant sales) advanced 2 percent for blast-furnace coke, 5 percent for foundry, 3 percent for water gas, 1 percent for other industrial, and 3 percent for domestic. For beehive coke, gains were registered for all grades except that sold for residential heating, which dropped 8 cents per ton or about 1 percent from 1948. The average value per ton of beehive coke sold for use in

blast furnaces and in the manufacture of water gas showed the sharpest gains, with increases of 7 percent each.

The effect of operating oven-coke plants near capacity levels since the beginning of World War II became apparent in 1949, and a large number of inefficient and deteriorated ovens had to be replaced. In all, 469 new slot-type ovens with an annual coke capacity of more than 2¼ million tons were completed and placed in operation during the year. In spite of this record, it is to be noted that the total number of ovens and annual coke capacity of the oven-coke industry dropped below the figures reported at the end of 1948. This is evidence that new construction in 1949 did not pace obsolescence, and construction of new ovens undoubtedly will have to be continued at a rapid pace in the future if oven-coke capacity is to be maintained at current or slightly higher levels. That oven-coke plant operators recognize this problem is shown by the large number of new ovens under construction at the close of the year.

Demands for coke for metallurgical and industrial purposes continued at extremely high levels throughout the year, and there was little change in the use pattern from preceding years. About 81 percent of the oven coke produced was utilized by blast furnaces, 4 percent by iron foundries, 7 percent for the manufacture of producer gas and water gas, 3 percent for miscellaneous industrial uses, and only 5 percent for residential heating. Beehive ovens shipped 84 percent of their production to blast furnaces, 6 percent to foundries, 3 percent for water-gas manufacture, 6 percent for other industrial purposes, and less than 1 percent for residential heating. The market for coke for household or residential heating has been shrinking steadily in the past decade, largely because of competition from oil and gas and also because of the increased requirements for metallurgical purposes.

Preliminary data from the Bureau's 1949 annual survey show that 21,200 men were employed at oven-coke plants and worked 58,930,000 man-hours—decreases from 1948 of 677 men and 4,858,377 man-hours. The number of men employed at beehive plants increased from 3,280 in 1948 to 3,400 in 1949, but the man-hours worked dropped from 6,233,002 to 3,550,000. The reduction in man-hours worked was due to the closing of virtually all beehive plants, beginning in July, while the increase in men was attributable to the large number of operations that were active, particularly during the first quarter of the year.

Production of the principal coal-chemical materials—gas, tar, ammonia, and crude light oil—which invariably accompany the production of oven coke all showed decreases when compared with 1948 figures. Coke-oven gas production declined 11 percent; tar, 9 percent; ammonia, 9 percent; and crude light oil, 11 percent. It is to be noted, however, that although the total production of these materials decreased, the average yield per ton of coal carbonized increased slightly, indicating an improvement in coal quality. Prices of the various coal chemicals varied only slightly from those of 1948. The total value of coke and breeze produced and coal-chemical materials sold exceeded a billion dollars for the third consecutive year.

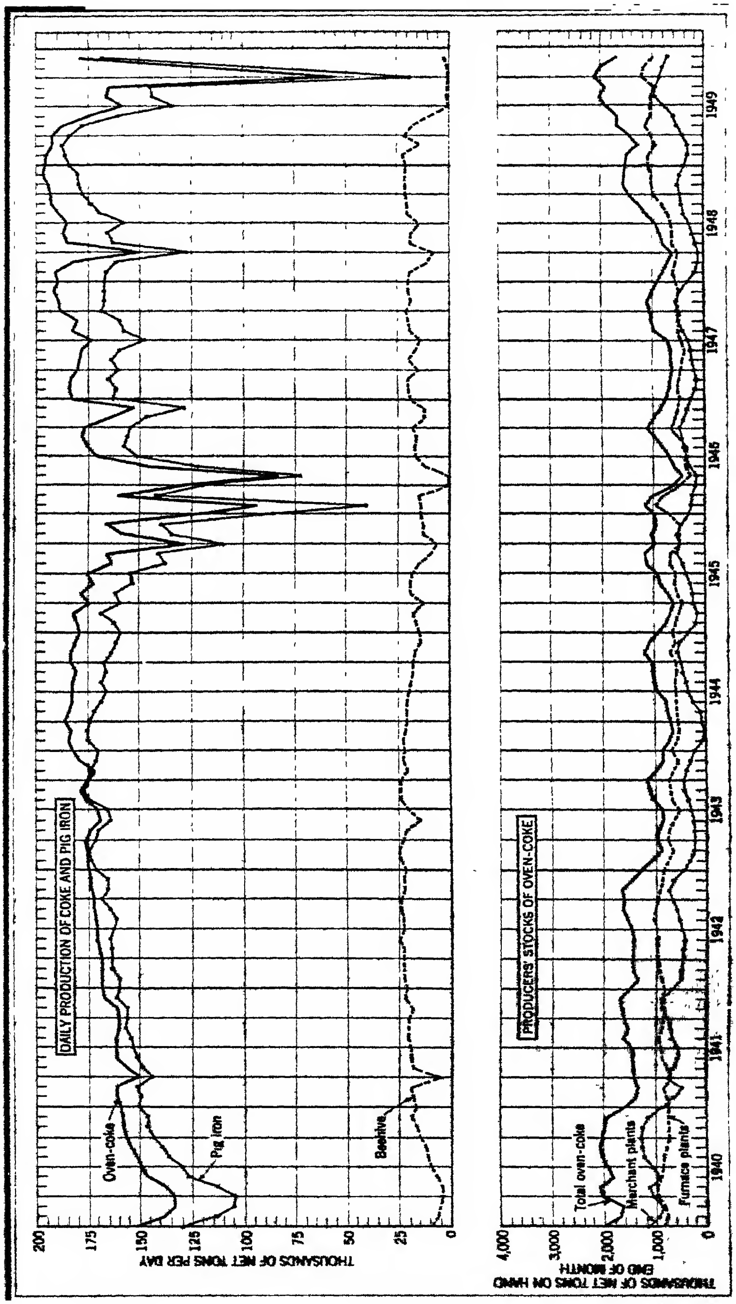

FIGURE 1.—Average daily production of oven and beehive coke and pig iron and producers' stocks of oven coke, 1940–49, by months.

TABLE 1.—Salient statistics of the coke industry in the United States in 1949

	Slot-type ovens	Beehive ovens	Total
Coke produced—			
At merchant plants:			
Net tons	12,112,922	(1)	(1)
Value	$181,084,964		
At furnace plants:			
Net tons	48,109,559		
Value	$617,707,105		
Total:			
Net tons	60,222,481	3,414,948	63,637,429
Value	$798,792,069	$43,945,627	$842,737,696
Screenings or breeze produced:			
Net tons	4,929,086	59,494	4,988,580
Value	$16,935,002	$129,436	$17,064,438
Coal charged into ovens:			
Bituminous:			
Net tons	85,881,576	5,354,495	91,236,071
Value	$732,076,635	$29,043,896	$761,120,531
Average per ton	$8.52	$5.42	$8.34
Anthracite:			
Net tons	172,825		172,825
Value	$1,269,973		$1,269,973
Average per ton	$7.35		$7.35
Total:			
Net tons	86,054,401	5,354,495	91,408,896
Value	$733,346,608	$29,043,896	$762,390,504
Average per ton	$8.52	$5.42	$8.34
Average yield in percent of total coal charged:			
Coke	69.98	63.78	69.62
Breeze (at plants actually recovering)	5.76	3.53	5.72
Ovens:			
In existence Jan. 1	15,139	14,078	29,217
In existence Dec. 31	15,104	13,662	28,766
Dismantled during year	504	647	1,151
In course of construction Dec. 31	562		562
Annual coke capacity Dec. 31 net tons	73,710,100	8,672,200	82,382,300
Coke used by producer—			
In blast furnaces:			
Net tons	35,046,393	67,518	35,113,911
Value	$451,981,030	$1,137,134	$453,118,164
In foundries:			
Net tons	80,395		80,395
Value	$1,230,026		$1,230,026
To make producer gas:			
Net tons	790,910		790,910
Value	$9,538,902		$9,538,902
To make water gas:			
Net tons	1,313,785		1,313,785
Value	$16,167,896		$16,167,896
For other purposes:			
Net tons	356,298	1,779	358,077
Value	$3,874,475	$25,102	$3,899,577
Coke sold—			
To financially affiliated companies—			
For blast-furnace use:			
Net tons	10,656,809	1,094,907	11,751,716
Value	$135,672,369	$12,324,470	$147,996,839
For foundry use:			
Net tons	52,433		52,433
Value	$1,158,472		$1,158,472
For manufacture of water gas:			
Net tons	721,076		721,076
Value	$9,867,867		$9,867,867
For other purposes:			
Net tons	192,713	554	193,267
Value	$2,573,912	$8,045	$2,581,957
To other consumers—			
For blast-furnace use:			
Net tons	2,950,619	1,698,607	4,649,226
Value	$41,574,447	$22,580,450	$64,154,897
For foundry use:			
Net tons	2,446,160	199,880	2,646,040
Value	$48,241,594	$3,050,392	$51,291,986
For manufacture of water gas:			
Net tons	1,267,885	114,973	1,382,858
Value	$17,135,440	$1,609,793	$18,745,233

See footnote at end of table.

TABLE 1.—Salient statistics of the coke industry in the United States in 1949—Continued

	Slot-type ovens	Beehive ovens	Total
Coke sold—Continued			
To other consumers—Continued			
For other industrial use:			
Net tons	1,452,791	199,908	1,652,699
Value	$20,258,191	$2,706,581	$22,964,772
For domestic use:			
Net tons	2,740,987	14,853	2,755,840
Value	$37,014,772	$175,269	$37,190,041
Disposal of screenings or breeze:			
Used by producer—			
For steam raising:			
Net tons	3,199,101	1,141	3,200,242
Value	$10,550,793	$4,704	$10,555,497
To make producer or water gas:			
Net tons	116,436		116,436
Value	$615,816		$615,816
For other purposes:			
Net tons	722,308	9	722,317
Value	$2,298,843	$115	$2,298,958
Sold:			
Net tons	1,055,459	35,531	1,090,990
Value	$4,106,014	$68,452	$4,174,466
Average receipts per ton sold (merchant sales):			
Furnace coke	$14.09	$13.29	$13.80
Foundry coke	$19.72	$15.26	$19.38
Water-gas coke	$13.51	$14.00	$13.56
Other industrial coke	$13.94	$13.54	$13.90
Domestic coke	$13.50	$11.80	$13.49
Screenings or breeze	$3.89	$1.93	$3.83
Stocks on January 1, 1950:			
Furnace coke ... net tons	838,718	51,580	890,298
Foundry coke ... do	13,120	1,118	14,238
Domestic and other coke ... do	864,720	200	864,920
Screenings or breeze ... do	1,433,289	7,327	1,440,616
Exports ... do	(1)	(1)	548,256
Imports ... do	(1)	(1)	277,507
Indicated consumption ... do	(1)	(1)	63,190,665
Coal-chemical materials produced:			
Tar ... gallons	672,407,370		672,407,370
Ammonium sulfate or equivalent ... pounds	1,605,611,937		1,605,611,937
Gas ... M cubic feet	882,309,827		882,309,827
Burned in coking process ... percent	36.77		36.77
Surplus sold or used ... do	61.90		61.90
Wasted ... do	1.33		1.33
Crude light oil ... gallons	228,754,333		228,754,333
Yield of coal-chemical materials per ton of coal:			
Tar ... gallons	7.81		7.81
Ammonium sulfate or equivalent ... pounds	20.08		20.08
Gas ... M cubic feet	10.25		10.25
Crude light oil ... gallons	2.77		2.77
Value of coal-chemical materials sold:			
Tar:			
Sold	$31,314,137		$31,314,137
Used by producer	$12,130,275		$12,130,275
Ammonia (sulfate and liquor)	$33,580,544		$33,580,544
Gas (surplus)	$121,378,832		$121,378,832
Crude light oil and derivatives	$37,862,825		$37,862,825
Other coal-chemical materials [2]	$14,574,303		$14,574,303
Total value of coke and breeze produced and coal-chemical materials sold [3]	$1,066,578,077	$44,075,063	$1,110,653,140

[1] Not separately recorded.
[2] Naphthalene, tar derivatives, and miscellaneous coal-chemical materials.
[3] Includes value of tar used by producer.

TABLE 2.—Statistical trends of the coke industry in the United States, 1937 and 1946–49.

	1937	1946	1947	1948	1949
Coke production:					
Oven...net tons..	49, 210, 748	53, 929, 447	66, 758, 549	68, 284, 357	60, 222, 481
Beehive...do....	3, 164, 721	4, 568, 401	6, 687, 301	6, 577, 571	3, 414, 948
Total...do....	52, 375, 469	58, 497, 848	73, 445, 850	74, 861, 928	63, 637, 429
Percent oven...	94. 0	92. 2	90. 9	91. 2	94. 6
Stocks of coke, end of year...net tons..	2, 595, 287	928, 766	1, 032, 237	1, 593, 441	1, 769, 456
Exports, all coke...do....	526, 683	1, 231, 327	835, 059	[1] 706, 782	548, 256
Imports, all coke...do....	286, 364	52, 188	104, 093	161, 400	277, 507
Indicated consumption, all coke...do....	51, 271, 929	57, 321, 756	72, 611, 413	73, 755, 342	63, 190, 665
Disposal, all coke sold or used:					
Furnace...do....	36, 751, 969	43, 700, 492	57, 636, 505	59, 285, 506	51, 514, 853
Foundry...do....	2, 038, 822	2, 996, 202	3, 650, 001	3, 750, 659	2, 778, 868
Other industrial (including producer and water gas)...do....	4, 597, 894	6, 593, 870	8, 028, 791	7, 733, 382	6, 412, 672
Domestic...do....	8, 107, 518	5, 096, 733	3, 977, 328	3, 445, 309	2, 755, 840
Coke ovens, end of year:					
Slot-type ovens in existence...	12, 718	14, 494	14, 728	15, 139	15, 104
Beehive ovens in existence...	12, 194	12, 864	13, 443	14, 078	13, 662
Slot-type ovens under construction...	259	824	572	350	562
Cost of coal charged, oven-coke plants, average per ton...	$3.74	$5.77	$6.78	$8.13	$8.52
Prices of coke:					
Average spot price of Connellsville furnace, f. o. b. ovens...	$4.29	$8.13	$10.49	$13.44	$13.77
Average receipts per ton of oven coke sold (merchant sales):					
Furnace...	$4.34	$8.85	$10.95	$13.78	$14.09
Foundry...	$8.47	$12.62	$14.79	$18.78	$19.72
Other industrial (including water gas)...	$6.08	$9.58	$11.13	$13.45	$13.74
Domestic...	$6.53	$9.90	$11.19	$13.17	$13.50
Yield of coal-chemical materials per ton of coal charged:					
Tar...gallons....	8.67	7.82	7.78	7.60	7.81
Ammonium sulfate or equivalent pounds..	21.84	19.79	19.66	19.52	20.08
Crude light oil...gallons..	2.86	2.77	2.75	2.73	2.77
Surplus gas sold or used..M cubic feet..	6.66	6.29	6.27	6.25	6.35
Average gross receipts for coal-chemical materials per ton of coke produced:					
Tar sold and used...	$0.502	$0.466	$0.605	$0.828	$0.722
Ammonia and its compounds...	$0.326	$0.361	$0.423	$0.545	$0.558
Crude light oil and its derivatives (including naphthalene)...	$0.435	$0.467	$0.566	$0.685	$0.673
Surplus gas sold or used...	$1.483	$1.542	$1.678	$1.839	$2.015
Total coal-chemical materials (including breeze)...	$2.974	$3.207	$3.710	$4.419	$4.447

[1] Revised figure.

TABLE 3.—Coke produced, value, number of ovens, coal charged, and average yield in the United States in 1949, by States

[Exclusive of screenings or breeze]

State	Oven coke						
	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
Alabama	7	1,311	7,282,457	70.87	5,161,397	$55,493,394	$10.75
California	1	135	578,484	59.91	346,552	(1)	(1)
Colorado	1	266	1,095,247	66.61	729,516	(1)	(1)
Illinois	8	900	4,590,854	69.61	3,195,645	52,258,356	16.35
Indiana	5	1,871	10,437,884	72.17	7,533,290	122,527,774	16.26
Maryland	1	483	2,839,947	71.83	2,039,957	(1)	(1)
Massachusetts	1	204	1,264,638	70.49	891,400	(1)	(1)
Michigan	4	568	3,480,364	71.38	2,484,409	34,773,316	14.00
Minnesota	3	196	1,098,718	71.17	781,943	12,693,926	16.23
New Jersey	2	341	1,838,202	73.17	1,345,094	(1)	(1)
New York	8	1,142	7,389,691	69.89	5,164,790	69,074,052	13.37
Ohio	15	2,248	12,688,184	70.23	8,911,140	111,443,394	12.51
Pennsylvania	13	3,730	21,647,307	68.22	14,768,809	179,838,346	12.18
Tennessee	1	44	304,913	69.98	213,378	(1)	(1)
Texas	2	125	709,108	70.09	497,019	(1)	(1)
Utah	2	308	1,466,527	61.49	901,829	(1)	(1)
West Virginia	5	718	4,519,527	70.42	3,182,857	34,370,765	10.80
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6	514	2,822,349	73.47	2,073,456	29,838,358	14.39
Undistributed						96,480,388	13.85
Total 1949	85	15,104	86,054,401	69.98	60,222,481	798,792,069	13.26
At merchant plants	30	3,057	16,960,295	71.42	12,112,922	181,084,964	14.95
At furnace plants	55	12,047	69,094,106	69.63	48,109,559	617,707,105	12.84
Total 1948	86	15,139	97,240,318	70.22	68,284,357	848,719,083	12.43

State	Beehive coke						Total	
	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens		Coke produced (net tons)	Value of coke at ovens
					Total	Per ton		
Alabama							5,161,397	$55,493,394
California							346,552	(1)
Colorado							729,516	(1)
Illinois							3,195,645	52,258,356
Indiana							7,533,290	122,527,774
Maryland							2,039,957	(1)
Massachusetts							891,400	(1)
Michigan							2,484,409	34,773,316
Minnesota							781,943	12,693,926
New Jersey							1,345,094	(1)
New York							5,164,790	69,074,052
Ohio							8,911,140	111,443,394
Pennsylvania	10,938	4,491,782	64.53	2,898,683	$36,367,550	$12.55	17,667,492	216,205,896
Tennessee							213,378	(1)
Texas							497,019	(1)
Utah	797	244,801	54.23	132,762	(1)	(1)	1,034,591	(1)
Virginia	750	263,983	59.78	157,812	2,300,193	14.58	157,812	2,300,193
West Virginia	982	276,686	64.01	177,108	2,535,415	14.32	3,359,965	36,906,180
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	195	77,243	62.90	48,583	(1)	(1)	2,122,039	(1)
Undistributed					2,742,460	15.12		128,061,215
Total: 1949	13,662	5,354,495	63.78	3,414,948	43,945,627	12.87	63,637,429	842,737,696
1948	14,078	10,321,568	63.73	6,577,571	79,562,771	12.10	74,861,928	928,281,854

[1] Included with "Undistributed."

SCOPE OF REPORT

The statistics in this chapter, except where otherwise noted, are based on data voluntarily supplied to the Bureau of Mines by coke-plant operators in the United States. The characteristic form and manner of presentation of material developed in preceding chapters is adhered to in this report, carrying the Bureau's series on coke and coal-chemical materials through 1949. In accordance with this procedure, most of the statistical tables herein include comparable data for three or four preceding years. The statistics are confined to the operation of high-temperature beehive and slot-type coke-oven plants. Salient statistics on medium- and low-temperature carbonization are shown separately in table 4 and similar data on the operation of coal-gas retorts are given in table 5. Coke is made by other processes not included in this report, namely, from the refining of petroleum and crude tar. Preliminary data for 1949 indicate that the production of petroleum coke totaled 3,392,000 net tons and output of pitch coke, as reported by the United States Tariff Commission, totaled 43,000 net tons. The standard unit of measurement in the coke industry in the United States is the short or net ton of 2,000 pounds. Unless otherwise specified, it is the unit employed throughout this chapter.

MEDIUM- AND LOW-TEMPERATURE COKE

TABLE 4.—Salient statistics of medium- and low-temperature carbonization plants in the United States in 1949

	Quantity	Value
Coke produced ... net tons	124,459	$1,153,082
Coal carbonized ... do	208,127	675,280
Average per ton		3.24
Average yield of coke in percent of coal carbonized	59.80	
Ovens and retorts:		
In existence Dec. 31	26	
Annual coke capacity Dec. 31 ... net tons	368,200	
Tar produced ... gallons	2,309,660	
Yield per ton of coal ... do	11.10	
Value of coke and breeze produced and coal-chemical materials sold		1,509,741

RETORT COKE

TABLE 5.—Salient statistics of the coal-gas industry in the United States in 1949 [1]

	Horizontal retorts	Vertical retorts	Total
Coke produced:			
Net tons	111,230	268,191	379,421
Value	$1,409,470	$2,982,837	$4,392,307
Screenings or breeze produced ... net tons	15,228	43,168	58,396
Coal charged into retorts:			
Net tons	172,224	450,986	623,210
Value	$1,933,764	$4,884,292	$6,818,056
Average per ton	$11.23	$10.83	$10.94
Average yield in percent of coal charged:			
Coke	64.58	59.47	60.88
Breeze (at plants actually recovering)	9.36	10.39	10.10
Retorts:			
In existence Dec. 31	586	272	858
In operation Dec. 31	329	208	537
Annual coal capacity ... net tons	246,000	537,700	783,700
Coke used by producers:			
Net tons	62,863	159,508	222,371
Value	$763,686	$1,661,066	$2,424,752
Coke sold to other consumers:			
Net tons	41,887	98,349	140,236
Value	$551,665	$1,178,760	$1,730,425
Stocks on Jan. 1, 1950:			
Coke ... net tons	10,221	47,609	57,830
Breeze ... do	3,183	1,439	4,622
Coal-chemical materials:			
Tar:			
Production ... gallons	2,146,775	6,599,539	8,746,314
Sales ... do	2,246,396	7,340,742	9,587,138
Value of sales	$154,402	$559,602	$714,004
Stocks on Jan. 1, 1950 ... gallons	355,926	918,363	1,274,289
Per ton of coal charged ... do	12.47	14.63	14.03
Crude light oil: [2]			
Production ... do	22,747	196,161	218,908
Sales ... do	27,109	204,920	232,029
Value of sales	$2,169	$16,311	$18,480
Stocks on Jan. 1, 1950 ... gallons	7,200	28,727	35,927
Per ton of coal charged ... do	0.89	1.43	1.35

[1] Additional data in Bureau of Mines, Production of Coke and Coal Chemicals from Coal-Gas Retorts in 1949: Mineral Market Rept. 1839, Mar. 23, 1950.
[2] Includes drip oil.

OVEN AND BEEHIVE COKE AND COKE BREEZE

GROWTH OF INDUSTRY

TABLE 6.—Historical statistics of the coke industry in the United States, 1880 and 1890–1949

Year	Production (million net tons): Oven coke	Production (million net tons): Beehive coke	Production (million net tons): Total	Percent of total production from slot-type ovens	Ovens in existence: Slot type	Ovens in existence: Beehive	Slot-type ovens under construction at end of year	Coal charged (million net tons)	Yield of coke from coal (percent)	Average value of coke per ton at plant	Total value at plant (million dollars): Beehive coke	Total value at plant (million dollars): Oven coke	Total value at plant (million dollars): All coal-chemical materials [1]	Total value at plant (million dollars): Total coke and coal-chemical materials
1880	------	3.3	3.3	------	------	12,372	------	5.2	63.7	$1.99	7	------	------	7
1890	------	11.5	11.5	------	------	37,158	------	18.0	63.9	2.02	23	------	------	23
1891	------	10.4	10.4	------	------	40,057	------	16.3	63.3	1.97	20	------	------	20
1892	------	12.0	12.0	------	------	42,002	------	18.8	63.8	1.96	24	------	------	24
1893	0.01	9.5	9.5	0.1	12	44,189	------	14.9	63.5	1.74	17	------	(2)	(2)
1894	.02	9.2	9.2	.2	12	44,760	60	14.4	64.0	1.34	12	------	(2)	(2)
1895	.02	13.3	13.3	.1	72	45,493	60	20.8	64.0	1.44	19		(2)	(2)
1896	.1	11.7	11.8	.7	160	46,784	120	18.7	63.1	1.84	22		(2)	(2)
1897	.3	13.0	13.3	2.0	280	47,388	240	20.9	63.6	1.66	22		(2)	(2)
1898	.3	15.7	16.0	1.8	520	47,863	500	25.2	63.6	1.59	26		(2)	(2)
1899	.9	18.8	19.7	4.6	1,020	48,583	65	30.2	65.1	1.76	35		(2)	(2)
1900	1.1	19.4	20.5	5.2	1,085	57,399	1,096	32.1	63.9	2.31	47		(2)	(2)
1901	1.2	20.6	21.8	5.4	1,165	62,786	1,533	34.2	63.7	2.04	44			
1902	1.4	24.0	25.4	5.5	1,663	67,406	1,346	39.6	64.1	2.49	63		(2)	(2)
1903	1.9	23.4	25.3	7.4	1,956	77,378	1,335	39.4	64.1	2.63	66		(2)	(2)
1904	2.6	21.1	23.7	11.0	2,910	80,689	832	36.5	64.8	1.95	46		(2)	(2)
1905	3.4	28.8	32.2	10.7	3,103	84,405	417	49.5	65.1	2.25	72		(2)	(2)
1906	4.6	31.8	36.4	12.5	3,547	90,354	112	55.7	65.3	2.52	92		(2)	(2)
1907	5.6	35.2	40.8	13.8	3,684	95,996	330	61.9	65.8	2.74	90	22	8	120
1908	4.2	21.8	26.0	16.1	3,799	97,419	240	39.4	66.0	2.40	48	14	7	69
1909	6.2	33.1	39.3	15.9	3,989	99,993	949	59.4	66.2	2.29	70	20	8	98
1910	7.1	34.6	41.7	17.1	4,078	100,362	1,200	63.1	66.1	2.39	75	25	8	108
1911	7.9	27.7	35.6	22.1	4,624	99,255	698	53.3	66.7	2.37	57	27	10	94
1912	11.1	32.9	44.0	25.3	5,211	97,919	793	65.6	67.1	2.54	69	43	14	126
1913	12.7	33.6	46.3	27.5	5,688	96,962	504	69.2	66.9	2.78	80	49	17	146
1914	11.2	23.4	34.6	32.5	5,809	93,946	644	51.6	66.9	2.56	50	38	18	106
1915	14.1	27.5	41.6	33.8	6,268	93,110	1,191	61.8	67.2	2.54	57	49	30	136
1916	19.1	35.4	54.5	35.0	7,283	91,581	2,084	81.6	66.8	3.13	96	75	62	233
1917	22.4	33.2	55.6	40.4	7,869	88,027	2,260	83.8	66.4	5.36	159	139	68	366
1918	26.0	30.5	56.5	46.0	9,279	84,635	1,815	85.0	66.4	6.77	189	193	77	459
1919	25.1	19.1	44.2	56.9	10,379	82,560	877	65.6	67.4	5.85	98	160	68	326
1920	30.8	20.5	51.3	60.0	10,881	75,298	396	76.2	67.4	9.27	163	313	105	581
1921	19.8	5.5	25.3	78.1	11,142	66,014	85	37.2	68.0	5.84	30	118	68	216
1922	28.5	8.6	37.1	76.9	11,212	63,958	403	54.3	68.3	6.42	50	188	95	333
1923	37.6	19.4	57.0	66.0	11,156	62,349	629	84.4	67.5	6.56	116	257	131	504
1924	34.0	10.3	44.3	76.8	11,413	60,432	247	65.0	68.1	5.51	48	196	120	364
1925	39.9	11.4	51.3	77.9	11,290	57,587	429	74.5	68.8	5.12	52	211	143	406
1926	44.4	12.5	56.9	78.0	11,716	52,558	978	82.9	68.6	5.41	57	251	157	465
1927	43.9	7.2	51.1	85.9	12,475	49,795	289	74.4	68.6	5.13	30	232	160	422
1928	48.3	4.5	52.8	91.5	12,544	41,288	145	77.2	68.4	4.79	16	237	177	430
1929	53.4	6.5	59.9	89.2	12,649	30,082	408	86.8	69.0	4.66	23	256	192	471
1930	45.2	2.8	48.0	94.2	12,831	23,907	276	69.8	68.7	4.36	10	200	168	378
1931	32.4	1.1	33.5	96.6	13,108	21,588	------	48.6	68.9	4.83	4	158	125	287
1932	21.1	.7	21.8	97.0	13,053	19,440	------	31.9	68.3	4.79	2	103	88	193
1933	26.7	.9	27.6	96.7	13,053	16,857	------	40.1	68.7	4.46	3	120	95	218
1934	30.8	1.0	31.8	96.8	12,963	14,206	------	46.0	69.2	5.01	4	155	104	263
1935	34.2	.9	35.1	97.4	12,860	13,674	122	50.5	69.6	5.03	4	173	113	290
1936	44.6	1.7	46.3	96.3	12,849	13,012	305	65.9	70.2	5.02	7	226	136	369
1937	49.2	3.2	52.4	94.0	12,718	12,194	259	74.5	70.3	4.98	14	247	151	412
1938	31.7	.8	32.5	97.4	12,724	10,816	146	46.6	69.7	5.14	4	163	116	283
1939	42.9	1.4	44.3	96.7	12,732	10,934	------	63.5	69.8	4.80	6	207	142	355
1940	54.0	3.1	57.1	94.6	12,734	15,150	492	81.4	70.1	4.80	14	260	168	442
1941	58.5	6.7	65.2	89.7	13,016	18,869	181	93.1	70.0	5.41	37	316	183	536
1942	62.3	8.3	70.6	88.3	13,303	16,395	1,327	100.8	70.0	6.03	47	378	204	629
1943	63.8	7.9	71.7	88.9	14,263	17,666	538	102.5	70.0	6.64	52	424	210	686
1944	67.0	7.0	74.0	90.6	14,580	16,318	180	105.3	70.3	7.13	49	479	208	736
1945	62.1	5.2	67.3	92.3	14,510	12,179	335	95.7	70.4	7.56	38	470	191	699
1946	53.9	4.6	58.5	92.2	14,494	12,864	824	83.5	70.0	8.32	37	450	173	660
1947	66.8	6.7	73.5	90.9	14,728	13,443	572	105.0	69.9	10.57	65	711	248	1,024
1948	68.3	6.6	74.9	91.2	15,139	14,078	350	107.6	69.6	12.40	79	849	302	1,230
1949	60.2	3.4	63.6	94.6	15,104	13,663	562	91.4	69.6	13.24	44	799	268	1,111

[1] Value for tar up to and including 1917 represented that of tar "obtained and sold" which did not always include value of tar used by producer. Beginning with 1918, tar used by producer is specifically included. Value of breeze produced at oven-coke plants is included for those years for which it was reported, namely, 1916, 1917, and 1919–49. For other coal-chemical materials, only value of those sold is included. Value of breeze produced at beehive plants is not included, as it has usually been much less than a million dollars.

[2] [illegible] value of the coal-chemical materials available.

MONTHLY AND WEEKLY PRODUCTION

Statistics on monthly production of coke shown in tables 7 to 9 are based upon reports received from producers. Weekly production of beehive coke shown in table 10 is estimated from reports of carloadings received from all coke-carrying railroads. The totals shown in these tables have been adjusted to the total ascertained by an annual canvass of the producers. Data on weekly production of beehive coke are published by the Bureau of Mines in the Weekly Anthracite and Beehive-Coke Report and monthly data for both oven and beehive coke are summarized in the Monthly Coke Report. These publications are distributed, free of charge, upon request to the Publications Distribution Section, Bureau of Mines, Washington 25, D. C.

TABLE 7.—Coke produced in the United States, 1937 and 1947–49, by months and average per day, in net tons [1]

Month	1937		1947		1948		1949	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
Oven coke:								
January	4,360,700	140,700	5,650,600	182,300	5,886,500	189,900	6,088,800	196,400
February	3,992,900	142,600	5,156,500	184,300	5,534,800	190,800	5,487,100	196,000
March	4,495,500	145,600	5,696,700	183,600	5,666,800	182,800	5,970,000	192,600
April	4,350,900	145,000	5,413,500	180,400	4,507,500	150,300	5,773,700	192,500
May	4,479,700	144,500	5,561,900	179,400	5,746,000	185,400	5,814,400	187,500
June	4,034,800	134,500	5,352,900	178,400	5,616,500	187,200	5,250,600	175,300
July	4,423,900	142,700	5,403,300	174,300	5,738,000	185,100	4,926,300	158,900
August	4,573,400	147,500	5,664,700	182,700	5,873,800	189,500	5,154,600	166,300
September	4,427,800	147,600	5,426,900	180,900	5,789,100	193,000	4,968,300	165,600
October	4,035,100	130,200	5,833,100	188,200	5,992,400	193,300	1,731,400	55,900
November	3,222,300	107,400	5,682,500	189,400	5,832,900	194,400	3,495,000	116,500
December	2,823,800	91,100	5,920,000	191,000	6,100,300	196,800	5,553,200	179,100
Total	49,239,800	134,800	66,758,600	182,900	68,284,400	186,600	60,222,500	165,000
Beehive coke:								
January	274,300	10,600	504,100	19,100	616,100	19,900	660,400	21,300
February	294,600	12,300	538,300	19,200	547,900	18,900	638,500	22,800
March	357,300	13,200	606,100	19,500	331,500	10,700	448,000	14,400
April	308,700	11,900	445,800	14,900	249,200	8,300	640,200	21,300
May	326,500	12,600	611,800	19,800	599,400	19,300	535,500	17,300
June	274,800	10,600	471,100	15,700	561,300	18,700	265,200	8,800
July	285,100	11,000	437,100	14,100	453,100	14,600	23,300	800
August	258,000	10,000	588,700	19,000	640,100	20,600	46,300	1,500
September	253,900	9,800	593,600	19,800	617,200	20,600	30,600	1,000
October	226,500	8,700	627,000	20,200	651,500	21,000	8,000	300
November	168,800	6,500	559,600	18,700	640,200	21,400	35,400	1,200
December	135,200	5,200	614,200	19,800	670,100	21,600	84,800	2,800
Total	3,164,700	10,260	6,667,300	18,300	6,577,600	17,900	3,414,900	9,300
Total:								
January	4,635,000	151,300	6,244,700	201,400	6,502,600	209,800	6,748,200	217,700
February	4,287,500	154,900	5,696,700	203,500	6,082,[illegible]	209,700	6,125,600	218,800
March	4,852,800	156,800	6,296,800	203,100	5,998,300	193,500	6,418,000	207,000
April	4,660,600	156,900	5,859,300	195,300	4,756,700	158,600	6,413,900	213,800
May	4,806,200	157,100	6,173,700	199,200	6,345,400	204,700	6,349,900	204,800
June	4,299,600	144,800	5,824,000	194,100	6,177,800	205,900	5,524,800	184,200
July	4,709,000	153,700	5,840,400	188,400	6,191,100	199,700	4,949,600	159,700
August	4,832,400	157,500	6,253,400	201,700	6,513,900	210,100	5,200,900	167,800
September	4,681,700	157,400	6,020,500	200,700	6,406,300	213,600	4,997,900	166,600
October	4,260,600	138,900	6,460,100	208,400	6,643,900	214,300	1,739,400	56,100
November	3,391,100	112,900	6,242,100	208,100	6,473,100	215,800	3,530,400	117,700
December	2,960,000	96,300	6,534,200	210,800	6,770,400	218,400	5,637,800	181,900
Grand total	52,373,800	145,000	73,445,900	201,200	74,862,000	204,500	63,637,400	174,300

[1] Before 1942 daily average production of beehive coke was calculated by subtracting Sundays and holidays in each month; 1942–49 daily average has been calculated by dividing total monthly production by total number of days in month.

TABLE 8.—Oven coke produced in the United States in 1949, by States and months, in net tons

[Based on reports from producers]

State	January	February	March	April	May	June	July
Alabama	545,600	484,400	508,200	482,700	504,600	450,400	411,500
California	27,700	25,000	25,800	24,000	24,700	24,500	26,600
Colorado	88,200	79,100	88,100	78,200	68,600	63,000	61,900
Illinois	319,300	288,500	313,600	299,200	303,800	269,900	250,300
Indiana	741,200	671,900	724,400	727,000	755,700	733,200	663,800
Maryland	188,400	171,200	190,300	184,500	187,500	180,900	180,400
Massachusetts	94,500	79,000	74,700	72,200	76,200	72,400	73,000
Michigan	245,200	224,100	241,100	232,600	180,800	221,200	210,100
Minnesota	72,900	66,100	74,100	70,500	71,200	67,300	66,200
New Jersey	117,300	110,500	121,600	118,700	122,600	116,100	121,600
New York	517,400	465,300	515,200	496,800	499,300	444,500	400,900
Ohio	922,900	829,600	895,900	860,300	890,200	747,600	686,500
Pennsylvania	1,499,200	1,355,100	1,501,700	1,453,800	1,474,300	1,302,100	1,234,600
Tennessee	20,900	18,500	20,200	20,100	20,000	18,700	16,500
Texas	58,500	53,500	58,400	57,400	59,900	48,800	38,100
Utah	100,200	86,000	101,600	100,400	81,200	70,100	72,500
West Virginia	332,400	302,400	317,500	306,200	302,300	257,700	244,600
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	197,000	176,900	197,600	189,100	191,500	171,200	167,200
Total	6,088,800	5,487,100	5,970,000	5,773,700	5,814,400	5,259,600	4,926,300
At merchant plants	1,154,900	1,042,800	1,126,100	1,072,400	1,081,700	1,009,000	983,000
At furnace plants	4,933,900	4,444,300	4,843,900	4,701,300	4,732,700	4,250,600	3,943,300

State	August	September	October	November	December	Total
Alabama	434,600	412,300	168,400	273,100	495,600	5,161,400
California	26,700	24,300	34,100	40,700	42,500	346,600
Colorado	64,000	58,100	----------	29,300	60,000	729,500
Illinois	267,300	276,200	116,500	196,700	295,300	3,195,600
Indiana	712,400	654,200	88,600	364,100	696,800	7,533,300
Maryland	185,200	175,200	43,000	172,600	180,800	2,040,000
Massachusetts	69,800	63,500	64,400	67,000	84,700	891,400
Michigan	218,900	218,100	123,500	130,400	238,400	2,484,400
Minnesota	64,400	65,200	34,000	63,100	66,900	781,900
New Jersey	118,700	111,900	91,100	81,700	113,400	1,345,100
New York	402,600	401,800	234,600	339,600	456,800	5,164,800
Ohio	766,000	747,200	178,000	514,200	874,100	8,911,100
Pennsylvania	1,394,000	1,247,200	205,900	813,700	1,387,200	14,768,800
Tennessee	16,600	15,900	11,300	15,900	18,800	213,400
Texas	27,700	24,700	11,500	30,800	37,700	497,000
Utah	76,300	69,900	26,800	47,900	68,900	901,800
West Virginia	246,300	235,500	184,600	193,100	260,300	3,182,900
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	163,100	167,200	135,900	141,700	175,100	2,073,500
Total	5,154,600	4,968,300	1,731,400	3,495,600	5,553,300	60,222,500
At merchant plants	988,300	974,400	823,000	806,000	1,051,300	12,112,900
At furnace plants	4,166,300	3,993,900	908,400	2,689,600	4,502,000	48,109,600

TABLE 9.—Beehive coke produced in the United States in 1949, by States and months, in net tons

[Based on reports from producers]

State	January	February	March	April	May	June	July
Kentucky	9,700	8,400	7,700	8,200	7,600	5,000	1,400
Pennsylvania	578,400	547,300	387,900	564,800	462,000	231,900	8,700
Utah	24,600	22,800	15,800	18,000	15,500	4,800	2,300
Virginia	21,500	21,000	12,500	21,800	22,300	11,900	9,200
West Virginia	34,300	38,400	24,300	27,400	28,100	11,600	1,700
Total	668,400	638,500	448,200	640,200	535,500	265,200	23,300

TABLE 9.—Beehive coke produced in the United States in 1949, by States and months, in net tons—Continued

State	August	September	October	November	December	Total
Kentucky						48,600
Pennsylvania	21,900	14,900	600	17,700	70,700	2,898,700
Utah	6,700	3,700	6,800	8,500	3,200	132,700
Virginia	14,600	6,200		8,100	8,100	157,800
West Virginia	3,100	4,800	600	1,100	2,500	177,100
Total	46,300	29,600	8,000	35,400	84,500	3,414,900

TABLE 10.—Beehive coke produced in the United States in 1949, by weeks

Week ended—	Net tons	Week ended—	Net tons	Week ended—	Net tons
Jan. 1	[1] 18,700	May 14	139,000	Sept. 24	4,700
Jan. 8	149,900	May 21	124,400	Oct. 1	3,500
Jan. 15	157,000	May 28	113,300	Oct. 8	2,100
Jan. 22	158,800	June 4	97,200	Oct. 15	1,700
Jan. 29	151,300	June 11	95,200	Oct. 22	2,400
Feb. 5	162,100	June 18	18,400	Oct. 29	1,700
Feb. 12	154,500	June 25	68,400	Nov. 5	2,200
Feb. 19	157,900	July 2	18,100	Nov. 12	3,000
Feb. 26	161,600	July 9	15,800	Nov. 19	6,600
Mar. 5	160,200	July 16	6,200	Nov. 26	11,500
Mar. 12	150,200	July 23	5,500	Dec. 3	11,300
Mar. 19	43,200	July 30	7,200	Dec. 10	12,600
Mar. 26	39,000	Aug. 6	7,000	Dec. 17	19,100
Apr. 2	114,700	Aug. 13	9,100	Dec. 24	19,200
Apr. 9	152,100	Aug. 20	9,200	Dec. 31	23,600
Apr. 16	136,600	Aug. 27	9,200		
Apr. 23	147,900	Sept. 3	10,900	Total	3,414,900
Apr. 30	171,400	Sept. 10	16,500		
May 7	128,[illegible]	Sept. 17	10,000		

[1] 1 day only.

PRODUCTION BY FURNACE AND MERCHANT PLANTS

Tables 11 and 12 show the production of oven coke by plants associated with iron blast furnaces designated by the Bureau of Mines as "furnace" plants and by other plants classified as "merchant." This classification applies only to oven-coke plants and is maintained by the Bureau of Mines in the interest of those who wish to follow the coking activities of the two groups. There were no changes in 1949 in the number of furnace and merchant plants that produced coke. The close relationship between the furnace-coke plants and the iron and steel industry is clearly illustrated in the production trend in 1949. The furnace oven-coke plants and blast furnaces, which in January operated at about 95 and 96 percent of capacity, respectively, started to cut back production in the second quarter because of a slackening in steel demand and dropped to a low of 18 and 10 percent in October because of the strike in the iron and steel industry. Coke production increased rapidly upon settlement of the strike in November, and by December, the furnace plants were operating at a slightly higher rate than the merchant group. The latter group, because of its diversified interests, did not make such drastic changes in their oven operations. Although production in 1949 fluctuated more than in 1948, the rate of operation varied from a high of 95 percent in the months of January

and February to a low of 66 in October. In spite of the more uniform operating rate of the merchant plants, this group accounted for only 20 percent of the total output of oven coke in 1949, reflecting the influence of the steel industry on coke production.

TABLE 11.—Number and production of oven-coke plants connected with iron furnaces and of other plants in the United States, 1913, 1918, 1937, and 1947–49

Year	Number of active plants		Coke produced (net tons)		Percent of production	
	Furnace plants	Merchant plants	Furnace plants	Merchant plants	Furnace plants	Merchant plants
1913	20	16	9,277,832	3,436,808	73.0	27.0
1918	36	24	19,220,342	6,777,238	73.9	26.1
1937	43	42	36,134,209	13,076,539	73.4	26.6
1947	54	32	52,860,850	13,807,609	79.2	20.8
1948	55	31	54,951,858	13,332,499	80.5	19.5
1949	55	31	48,109,550	12,112,922	79.9	20.1

TABLE 12.—Monthly and average daily production of oven coke by plants connected with iron furnaces and by other plants in the United States, 1937 and 1948–49, in net tons

Month	1937		1948		1949	
	Furnace plants	Merchant plants	Furnace plants	Merchant plants	Furnace plants	Merchant plants
Monthly production:						
January	3,241,600	1,119,100	4,702,600	1,183,900	4,933,900	1,154,900
February	2,996,500	996,400	4,453,700	1,080,900	4,444,300	1,042,800
March	3,355,000	1,140,500	4,518,900	1,147,900	4,843,900	1,126,100
April	3,310,300	1,040,600	3,578,000	930,500	4,701,300	1,072,400
May	3,375,600	1,104,100	4,618,300	1,127,700	4,732,700	1,081,700
June	2,917,500	1,107,300	4,508,500	1,108,000	4,250,600	1,009,000
July	3,316,100	1,107,800	4,607,400	1,130,600	3,943,300	983,000
August	[illegible]	1,104,100	4,745,100	1,128,700	4,166,300	988,300
September	3,334,700	1,093,100	4,680,000	1,100,100	3,993,900	974,400
October	2,910,500	1,124,600	4,863,200	1,129,200	908,400	823,000
November	2,142,700	1,079,600	4,719,200	1,113,700	2,689,000	806,000
December	1,764,400	1,058,400	4,948,000	1,152,300	4,502,000	1,051,300
Total	36,134,200	13,076,600	54,951,900	13,332,500	48,109,600	12,112,900
Average daily production:						
January	104,600	36,100	151,700	38,200	159,200	37,200
February	107,000	35,600	153,600	37,300	158,700	37,300
March	108,200	36,800	145,800	37,000	156,300	36,300
April	110,300	34,700	119,300	31,000	156,700	35,800
May	108,900	35,600	149,000	36,400	152,600	34,900
June	97,300	36,900	150,300	36,900	141,700	33,600
July	107,000	35,700	148,600	36,500	127,200	31,700
August	111,900	35,600	153,100	36,400	134,400	31,900
September	111,200	36,400	156,300	36,700	133,100	32,500
October	93,900	36,300	156,900	36,400	29,300	26,500
November	71,400	36,000	157,300	37,100	89,600	26,900
December	56,900	34,300	159,600	37,200	145,200	33,900
Average for year	99,000	35,800	150,200	36,400	131,800	33,200

PRODUCTION BY STATES AND DISTRICTS

There has been a marked change in the principal producing centers of coke in the last half century. In the early days of the coke industry, beehive-coke ovens were the principal source of metallurgical fuel, and the principal centers of coke production were naturally those States with ample supplies of coking coal. Thus, in 1910, Pennsyl-

vania accounted for 63 percent of the total output of coke in the United States, and West Virginia and Alabama for 9 and 8 percent, respectively. Development of the slot-type coke oven and its adaptation to the production of blast-furnace coke, with the added advantage of recovering the valuable chemical raw materials, resulted in a shifting of the centers of coke production from the coal fields to areas near the sources of iron-ore supply or near the steel-consuming centers. This development enabled Ohio, Indiana, New York, and Illinois to expand coke-making facilities and the quantity of coke produced in these States increased steadily. Other States located great distances from coal-producing fields constructed oven-coke plants in ensuing years; and in 1949, coke was produced in 22 States scattered from the Pacific Ocean to the Atlantic Seaboard and from the Canadian border to the Gulf of Mexico. Pennsylvania maintained its rank as the leading oven-coke producing State, supplying 25 percent of the total United States output. Ohio, which produced only modest quantities (less than a million tons and ranking ninth) until the beginning of World War I, added coke ovens at a tremendous rate and by the end of that war had gained second place, a position maintained since. The output of oven coke in Ohio in 1949 represented 15 percent of the total production. Indiana has been third since 1917, supplying 13 percent of the total in 1949, and Alabama and New York together accounted for 17 percent.

TABLE 13.—Coke produced in the United States, 1937 and 1946–49, by States, in net tons

[Exclusive of screenings or breeze]

State	1937	1946	1947	1948	1949
Oven coke:					
Alabama	4,259,771	4,665,939	5,869,738	6,015,460	5,161,307
California		260,470	332,244	296,749	346,552
Colorado	486,945	558,545	849,697	976,504	729,516
Illinois	2,998,663	3,192,395	3,806,374	3,675,284	3,195,645
Indiana	5,467,061	6,651,567	8,785,687	8,584,225	7,533,290
Maryland	1,513,651	1,861,606	1,975,201	2,147,787	2,039,957
Massachusetts	1,130,620	1,046,267	1,196,010	1,066,701	891,400
Michigan	2,283,518	2,499,664	2,818,941	2,849,601	2,484,409
Minnesota	704,631	860,754	897,739	846,346	781,943
New Jersey	1,015,073	1,256,854	1,432,316	1,416,941	1,345,004
New York	4,946,964	5,042,674	5,670,233	5,687,225	5,164,799
Ohio	6,737,881	8,451,580	10,060,237	10,562,465	8,911,149
Pennsylvania	13,701,262	12,794,721	16,474,893	16,649,[illegible]	14,762,[illegible]
Tennessee	99,451	229,751	241,925	251,438	213,378
Texas			263,006	644,336	497,019
Utah	149,659	487,133	975,773	1,068,501	961,829
Washington	14,656				
West Virginia	1,817,998	2,162,463	2,832,381	3,298,696	3,182,857
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,896,949	2,185,074	2,278,161	2,273,215	2,073,456
Total	49,[illegible],748	53,[illegible],447	66,758,549	68,284,357	60,222,481
Beehive coke:					
Colorado	64,322	58,761	21,489		
Kentucky		86,400	95,285	161,745	48,563
Pennsylvania	2,[illegible],048	4,837,167	5,913,133	5,782,856	2,[illegible]
Tennessee	14,863				
Utah	4,657	5,234	67,663	188,586	132,762
Virginia	349,426	171,342	211,876	300,911	157,819
West Virginia	278,367	239,997	377,825	302,484	377,166
Total	3,164,721	4,986,401	6,687,381	6,877,871	[illegible]
Grand total	52,375,469	58,487,848	73,446,[illegible]	74,[illegible]	[illegible]

There was no change from 1948 in the number of States producing beehive coke. Pennsylvania continued to lead in production with 85 percent of the total, followed by West Virginia and Virginia with 5 percent each.

TABLE 14.—Production of oven coke, by geographic areas, 1937, 1940, and 1946–49, in net tons

Geographic areas	1937	1940	1946	1947	1948	1949
Connecticut, Massachusetts, and Rhode Island	1, 717, 558	1, 779, 306	1, 663, 316	1, 890, 973	1, 746, 550	1, 543, 356
Maryland, New Jersey, New York, and Pennsylvania	21, 176, 950	22, 641, 242	20, 757, 855	25, 552, 637	25, 895, 642	23, 318, 650
Ohio	6, 737, 881	7, 897, 929	8, 451, 580	10, 069, 237	10, 562, 486	8, 911, 140
Illinois, Indiana, and Missouri	8, 730, 680	9, 660, 017	10, 109, 231	12, 868, 508	12, 539, 204	10, 948, 153
Michigan, Minnesota, and Wisconsin	3, 589, 795	3, 944, 410	3, 970, 174	4, 342, 188	4, 327, 342	3, 809, 174
Alabama, Kentucky, Tennessee, and West Virginia	6, 606, 624	7, 328, 908	7, 671, 143	9, 614, 287	10, 237, 154	9, 217, 092
California, Colorado, Texas, Utah, and Washington	651, 260	762, 497	1, 306, 148	2, 420, 719	2, 975, 979	2, 474, 916
Total	49, 210, 748	54, 014, 309	53, 929, 447	66, 758, 549	68, 284, 357	60, 222, 481

TABLE 15.—Oven coke produced in the United States in 1949, by steel-producing districts

District	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
Eastern	21	3, 609	21, 183, 017	71. 22	15, 086, 946	$205, 587, 066	$13. 63
Pittsburgh-Youngstown	21	4, 428	27, 152, 399	68. 15	18, 503, 441	214, 540, 489	11. 59
Cleveland-Detroit	10	1, 652	9, 147, 302	71. 16	6, 509, 485	86, 244, 427	13. 25
Chicago	19	3, 226	17, 134, 947	71. 63	12, 272, 918	200, 168, 656	16. 31
Southern	10	1, 480	8, 296, 478	70. 77	5, 871, 794	65, 617, 672	11. 18
Western	4	709	3, 140, 258	62. 99	1, 977, 897	26, 633, 759	13. 47
Total	85	15, 104	86, 064, 401	69. 98	60, 222, 481	798, 792, 069	13. 26

TABLE 16.—Coke produced in Pennsylvania in 1949, by districts

District	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
Oven coke:							
Eastern [1]	5	796	4, 345, 365	71. 66	3, 113, 959	$43, 717, 177	$14. 04
Western [2]	8	2, 934	17, 301, 942	67. 36	11, 654, 850	136 121, 169	11. 68
Total	13	3, 730	21, 647, 307	68. 22	14, 768, 809	179, 838, 346	12. 18
Beehive coke:							
Fayette County	41	8, 238	3, 152, 316	64. 73	2, 040, 580	24, 819, 973	12. 16
Westmoreland County	19	2, 096	966, 684	64. 55	624, 010	8, 369, 917	13. 41
Other counties [3]	3	604	372, 782	62. 80	234, 093	3, 177, 660	13. 57
Total	63	10, 938	4, 491, 782	64. 53	2, 898, 683	36, 367, 550	12. 55
Grand total	76	14, 668	26, 138, 989	67. 59	17, 667, 492	216, 205, 896	12. 24

[1] Includes plants at Bethlehem, Chester, Philadelphia, Steelton, and Swedeland.
[2] Includes plants at Aliquippa, Clairton, Erie, Johnstown, Midland, Monessen, Neville Island, and Pittsburgh.
[3] Beaver, Greene, and Indiana.

NUMBER AND TYPE OF OVENS

Slot-Type Coke Ovens.—In spite of the high level of construction maintained by coke-plant operators in 1949, the total number of ovens in existence at the close of the year was 35 less than at the close of 1948. This development clearly shows that virtually all of the new ovens completed were replacements of old batteries. The estimated life of the batteries depends on the operating conditions at each plant and upon the decision of the owners as to when maintenance and repairs on old batteries become excessive. The consensus of opinion of builders and operators of ovens indicates that, with few exceptions, ovens older than 20 years become increasingly more difficult to maintain in good operating condition. The percentage of coke ovens over 20 years has increased steadily in the past 10 years, as shown in table 18. It is evident that new-oven construction will have to be increased rapidly in the next few years to compensate for obsolescence and old-oven failures if the number of efficient ovens is to be maintained at or above the present level.

At the close of the year, 562 new ovens were under construction, and contracts were pending on several additional batteries. Most of the new ovens under construction are replacements of old batteries, and the net gain in ovens will not be great.

Beehive Ovens.—The beehive-coke oven was the type of equipment used exclusively in the production of metallurgical coke in the United States before 1893. Development of the beehive industry reached its maximum stage in 1910, when over 100,000 ovens of this type were in existence. Since that year, the number has declined steadily, and the present-day importance of this type of equipment lies chiefly in its ability to provide a quick and inexpensive means of producing coke to meet peak demands. No better example of this service can be given than the record of production of metallurgical coke achieved by the beehives since the beginning of World War II. They have been furnishing 8 to 10 percent of the coke requirements, and the number in operation has ranged from 10,000 to 12,000 monthly. At the beginning of 1949, steel production was at extremely high levels, and the number of beehives active in the first quarter averaged 12,500. The reduction in blast-furnace operation in the second quarter affected a few beehive plants, and the number of active ovens declined. Initiation of a 3-day workweek in the bituminous-coal industry in July made it economically unfeasible to operate the ovens, and nearly all were closed, dropping to 344 ovens in October. The return of the miners to a 5-day workweek in December permitted a number of plants to resume operation, and the average number of active ovens increased to 4,079. Additional ovens were being reactivated at the close of the year to meet rising metallurgical coke requirements.

TABLE 17.—Ovens completed and abandoned in the United States in 1949 and total number in existence at end of year, by States

State	Plants in existence Dec. 31	Ovens						
		In existence Dec. 31		New		Abandoned during year	Under construction Dec. 31	
		Number	Annual coke capacity (net tons)	Number	Annual coke capacity (net tons)		Number	Annual coke capacity (net tons)
Oven coke:								
Alabama	7	1,311	6,446,000	30	96,000	30		
California	1	135	532,500	45	177,500			
Colorado	1	266	1,000,000	[1] 4	27,700			
Connecticut	1	70	(2)					
Illinois	8	900	3,904,600	51	261,000	3		
Indiana	5	1,871	9,341,800	77	400,000	69	142	911,000
Kentucky	1	120	(2)					
Maryland	1	483	2,520,000				65	408,000
Massachusetts	1	204	1,260,000	41	248,000	52		
Michigan	4	568	2,923,500				16	123,000
Minnesota	3	196	872,400				77	339,400
Missouri	1	64	(2)					
New Jersey	2	341	1,552,000	37	137,500			
New York	8	1,142	6,197,400					
Ohio	15	2,248	10,934,800	123	602,300	167	105	608,000
Pennsylvania	13	3,730	18,115,500	61	325,300	183	157	885,600
Rhode Island	1	65	(2)					
Tennessee	1	44	252,000					
Texas	2	125	686,800					
Utah	2	308	1,180,600					
West Virginia	5	718	3,671,300					
Wisconsin	2	195	(2)					
Undistributed			2,318,900					
Total	85	15,104	73,710,100	469	2,275,300	504	562	3,275,000
At merchant plants	30	3,057	14,209,200	129	646,500	55		
At furnace plants	55	12,047	59,500,900	340	1,628,800	449	562	3,275,000
Beehive coke:								
Kentucky	1	196	172,900					
Pennsylvania	63	10,938	7,288,800	[3] 201	119,200	647		
Utah	2	797	315,800					
Virginia	5	750	375,000					
West Virginia	8	982	583,400	[3] 30	15,000			
Total	79	13,663	8,672,200	[3] 231	134,200	647		

[1] Abandoned ovens which were repaired and placed in operation.
[2] Included with "Undistributed."
[3] Old ovens rehabilitated.

TABLE 18.—Age of slot-type ovens in the United States on Dec. 31, 1949, by merchant and furnace plants [1]

Age	Merchant plants		Furnace plants		Total			
	Number of ovens	Annual coke capacity (net tons)	Number of ovens	Annual coke capacity (net tons)	Number of ovens	Percent of total	Annual coke capacity (net tons)	Percent of total
Under 5 years	266	1,290,500	1,519	8,578,800	1,785	11.8	9,869,300	13.4
From 5 to 10 years	416	2,189,400	2,561	13,792,500	2,977	19.7	15,981,900	21.7
From 10 to 15 years	120	460,000	1,383	7,228,600	1,503	10.0	7,688,600	10.4
From 15 to 20 years	130	675,800	260	1,330,400	390	2.6	2,006,200	2.7
From 20 to 25 years	908	4,712,800	1,213	6,732,300	2,121	14.0	11,445,100	15.5
25 years and over	1,222	4,880,700	5,106	21,838,300	6,328	41.9	26,719,000	36.3
Total	3,057	14,209,200	12,047	59,500,900	15,104	100.0	73,710,100	100.0

[1] Determined by first year of operation or after rebuilding or major repairs.

TABLE 19.—Slot-type ovens, by kinds, in the United States, end of 1949, by States

State	Koppers	Koppers-Becker	Semet-Solvay	Wilputte	All others [1]	Total
Alabama	517	549	180	65		1,311
California		135				135
Colorado	120	146				266
Connecticut		70				70
Illinois	371	246	120	163		900
Indiana	406	743	161	561		1,871
Kentucky			120			120
Maryland	300	183				483
Massachusetts		149		55		204
Michigan		222	346			568
Minnesota	155	41				196
Missouri	56				8	64
New Jersey	165	176				341
New York	150	608	180	152	52	1,142
Ohio	1,241	392	293	322		2,248
Pennsylvania	1,550	1,766	88	206	120	3,730
Rhode Island	40	25				65
Tennessee			24	20		44
Texas		125				125
Utah		308				308
West Virginia	154	419		145		718
Wisconsin	100	15	80			195
Total	5,325	6,318	1,592	1,689	180	15,104
At merchant plants	677	1,187	722	411	60	3,057
At furnace plants	4,648	5,131	870	1,278	120	12,047

[1] Comprises 52 American Foundation, 120 Cambria, and 8 Piette.

TABLE 20.—Average number of beehive ovens active in the United States in 1949, by months

Month	Number	Month	Number	Month	Number
January	12,456	May	12,029	September	1,448
February	12,509	June	8,733	October	344
March	12,544	July	1,604	November	2,140
April	12,620	August	1,468	December	4,079

CAPACITY OF OVEN-COKE PLANTS

The potential annual coke capacity of oven-coke plants, as reported by operators, was 1 percent lower on December 31, 1949, than at the end of 1948. The decrease in capacity may be attributed to the following: (1) A large number of old batteries that require longer coking cycles and (2) the rebuilding of a number of old batteries that were dismantled and out of production at the end of 1949. The basis for calculating the potential annual coke capacity of a plant is the minimum coking time necessary to produce a coke with the qualities suitable for its intended use. For this reason, the potential capacity of a plant is subject to change from year to year, depending on the age and condition of ovens, character and quality of coal charged, type of coke required, and other related economic conditions. The potential capacity, reported by the Bureau of Mines, may differ, therefore, from the rated capacity estimated by the coke-oven builders at the time of construction. It is believed, however, that the potential capacity as shown in table 21 is a good measure of the practical operating capacity. Although 2,275,300 tons of coke capacity were completed in 1949, the total annual coke capacity decreased, indicating an extremely high rate of oven failures. At the end of the year, construction was

in progress on over 3,000,000 tons of coke capacity, but it is likely that most of this capacity will be replacement of old batteries.

Table 22 shows, by months, the ratio of coke production to capacity during 1949 and several prior years. The ovens were operated at an extremely high rate in the first quarter, declining in the second and third quarters, and dropping sharply in October because of the strikes in the iron, steel, and coal industries. Although the operating rate increased rapidly in the latter part of November and in December, it still was not as high at the close of the year as it was in the first quarter. Indications at the beginning of 1950 point to continuation of a high operating rate for some months to come.

TABLE 21.—Potential maximum annual coke capacity of all oven-coke plants in existence in the United States, 1937 and 1945–49

Year	Plants	Ovens	Potential maximum annual coke capacity (net tons)	Percent of change from 1937
1937	87	12,718	62,727,100	
1945	88	14,510	71,399,100	+13.8
1946	87	14,494	71,112,600	+13.4
1947	86	14,728	72,549,100	+15.7
1948	86	15,139	74,499,900	+18.8
1949	85	15,096	73,710,100	+17.5

TABLE 22.—Relationship of production to potential maximum capacity [1] at oven-coke plants in the United States, 1937 and 1946–49, by months, in percent

Month	1937	1946	1947	1948	1949	Month	1937	1946	1947	1948	1949
January	83.0	61.8	91.0	94.8	95.2	August	86.0	88.4	90.5	93.1	80.3
February	83.5	47.4	92.0	94.7	95.0	September	86.1	89.4	89.3	94.9	79.8
March	84.9	81.3	91.7	90.9	93.3	October	76.0	89.2	91.3	93.9	26.9
April	84.9	64.6	90.1	74.6	93.3	November	62.8	82.4	91.9	94.0	55.8
May	84.6	41.7	89.6	92.0	90.8	December	53.1	77.2	92.6	95.0	86.2
June	78.6	73.9	89.1	93.3	84.9						
July	83.2	86.2	88.9	92.2	77.0	Year	78.8	73.8	90.5	92.0	79.7

[1] Capacity of all ovens in existence, whether active or idle, based upon maximum daily capacity times days in month.

QUANTITY AND COST OF COAL CHARGED

The coke industry (oven- and beehive-coke operations) in 1949 was the largest individual consumer of bituminous coal in the United States for the second consecutive year, taking more than one-fifth of the total annual output. Strikes in the steel and bituminous-coal industries during 1949 materially reduced the consumption of bituminous coal, and the total quantity charged into slot-type and beehive-coke ovens decreased 15 percent from the record established in 1948, amounting to about 91,236,000 net tons. In addition to this figure, approximately 172,800 tons of anthracite were used for mixing with bituminous at nine coke plants. Under normal conditions, the monthly consumption of bituminous coal is quite uniform because of

the continuous nature of the coking process. However, interruptions in coking operations during 1949 because of the reasons given above caused the monthly output to fluctuate from a high of 8,658,200 tons in January to 2,474,000 tons in October, the lowest figure since May 1946.

The cost of coal constitutes the chief item of expense in the manufacture of coke. In the past 10 years coal costs have been rising steadily because of increases in mining and transportation charges. The average cost of coal at oven-coke plants in 1949, the highest on record, increased $0.39 per ton or 5 percent over 1948 and was 132 percent higher than the 1940 figure. A large part of the coal used at oven-coke plants is "long-haul" coal, which necessarily increases the cost at ovens. For this reason Rhode Island, California, and Massachusetts had the highest average costs, while West Virginia, which obtains coal from nearby fields, had the lowest. Details on the quantity and cost of coal at ovens, by States, are shown in table 24.

Although coal costs at beehive ovens in 1949 were the highest ever recorded in the industry, they were lower than at oven-coke plants because of their proximity to the mines. However, in recent years, some of the beehive operators have been burdened with an additional cost in trucking part, or in some cases all, of their coal requirements. The average cost of coal charged into beehive ovens was $0.31 per ton or 6 percent higher than the previous maximum in 1948 and 172 percent above the 1940 average. West Virginia beehive operators had the lowest cost, while Utah and Kentucky registered the highest.

TABLE 23.—Coal consumed in coke ovens in the United States, 1937 and 1948–49, by months, in net tons

Month	1937			1948			1949		
	Coke oven	Beehive	Total	Coke oven [1]	Beehive	Total	Coke oven [2]	Beehive	Total
Jan	6,198,700	426,600	6,625,300	8,398,300	994,600	9,392,900	8,658,200	1,033,400	9,691,600
Feb	5,679,900	458,500	6,138,400	7,908,500	880,600	8,789,100	7,839,600	997,100	8,836,700
Mar	6,387,000	556,800	6,943,800	8,092,600	522,300	8,614,900	8,518,600	707,300	9,225,900
Apr	6,183,800	486,800	6,664,600	6,482,300	407,000	6,889,300	8,261,100	997,900	9,258,900
May	6,368,500	509,700	6,878,200	8,175,500	933,400	9,108,900	8,303,900	826,400	9,130,300
June	5,729,200	430,500	6,159,700	8,032,700	874,500	8,907,200	7,524,900	408,300	7,933,200
July	6,217,200	441,700	6,658,900	8,215,000	721,400	8,936,400	7,029,700	[illegible]	[illegible]
Aug	6,425,800	401,100	6,826,900	8,345,900	994,900	9,340,800	7,379,300	[illegible]	[illegible]
Sept	6,220,700	392,800	6,613,500	8,193,200	956,300	9,149,500	7,064,100	[illegible]	[illegible]
Oct	5,664,800	351,600	6,016,400	8,495,700	1,009,600	9,505,300	2,474,000	15,300	2,489,300
Nov	4,527,000	264,000	4,791,000	8,263,700	986,900	9,250,600	5,062,400	61,200	5,112,600
Dec	3,972,800	212,700	4,185,500	8,641,900	1,035,100	9,677,000	7,968,700	138,900	8,095,600
Total	69,575,400	4,926,800	74,502,200	97,240,300	10,321,600	107,561,900	86,054,400	5,354,500	91,408,900

[1] Includes 256,200 tons of anthracite fines.
[2] Includes 172,800 tons of anthracite fines.

TABLE 24.—Quantity and value at ovens of coal used in manufacturing coke in the United States in 1949, by States

State	Coal used (net tons)	Cost of coal		Coal per ton of coke	
		Total	Per ton	Net tons	Cost
Oven coke:					
Alabama	7,282,457	$49,610,462	$6.81	1.41	$9.61
California	578,484	(1)	(1)	1.67	(1)
Colorado	1,095,247	(1)	(1)	1.50	(1)
Illinois	4,590,854	44,743,167	9.75	1.44	14.00
Indiana	10,437,884	101,352,413	9.71	1.39	13.45
Maryland	2,839,947	(1)	(1)	1.39	(1)
Massachusetts	1,264,638	(1)	(1)	1.42	(1)
Michigan	3,480,364	31,300,860	8.99	1.40	12.60
Minnesota	1,098,718	11,096,368	10.10	1.41	14.19
New Jersey	1,838,202	(1)	(1)	1.37	(1)
New York	7,389,691	72,619,888	9.83	1.43	14.06
Ohio	12,668,184	106,811,764	8.42	1.42	11.99
Pennsylvania	21,647,307	165,353,676	7.64	1.47	11.20
Tennessee	304,913	(1)	(1)	1.43	(1)
Texas	709,108	(1)	(1)	1.43	(1)
Utah	1,466,527	(1)	(1)	1.63	(1)
West Virginia	4,519,527	28,788,809	6.37	1.42	9.04
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	2,822,349	26,839,309	9.51	1.36	12.94
Undistributed		94,829,892	9.39	1.45	13.62
Total	86,054,401	733,346,608	8.52	1.43	12.18
At merchant plants	16,960,295	158,301,188	9.33	1.40	13.07
At furnace plants	69,094,106	575,045,420	8.32	1.44	11.95
Beehive coke:					
Kentucky	77,243	(1)	(1)	1.59	(1)
Pennsylvania	4,491,782	24,358,310	5.42	1.55	8.40
Utah	244,861	(1)	(1)	1.84	(1)
Virginia	263,983	1,427,389	5.41	1.67	9.04
West Virginia	276,536	1,480,156	5.35	1.56	8.36
Undistributed		1,777,841	5.52	1.78	9.80
Total	5,354,405	29,043,696	5.42	1.57	8.50

[1] Included with "Undistributed."

TABLE 25.—Average cost per net ton of coal carbonized at oven-coke plants in the United States, 1937 and 1945–49, by States

State	1937	1945	1946	1947	1948	1949
Alabama	$2.33	$4.47	$4.96	$5.57	$6.48	$6.81
Illinois	4.62	6.16	6.70	8.00	9.38	9.75
Indiana	4.71	6.23	6.75	8.01	9.35	9.71
Michigan	4.16	5.55	5.97	6.79	8.26	8.99
Minnesota	5.24	6.52	6.86	8.33	9.90	10.10
New York	4.55	6.04	6.71	7.76	9.48	9.83
Ohio	3.76	5.27	5.72	6.76	8.11	8.42
Pennsylvania	2.98	4.40	4.79	5.87	7.22	7.64
West Virginia	2.54	3.56	3.84	4.72	6.14	6.37
Other States [1]	4.53	5.94	6.51	7.46	8.88	9.42
United States average	3.74	5.26	5.77	6.78	8.13	8.52
Cost of coal per ton of coke	5.27	7.45	8.17	9.60	11.58	12.18

[1] California, Colorado, Connecticut, Kentucky, Maryland, Massachusetts, Missouri, New Jersey, Rhode Island, Tennessee, Texas, Utah, and Wisconsin.

TABLE 26.—Cost of coal and value of products per net ton of coke produced in the United States, 1918, 1929, 1937, and 1945–49

Year	Oven coke				Beehive coke	
	Cost of coal per ton of coke	Value per ton of coke produced			Cost of coal per ton of coke	Value per ton
		Coke	Coal-chemical materials [1]	Total		
1918	$6.00	$7.42	$3.08	$10.50	$3.65	$6.21
1929	5.04	4.80	3.56	8.36	2.85	3.49
1937	5.27	5.03	2.97	8.00	3.14	4.31
1945	7.45	7.57	3.07	10.64	5.48	7.36
1946	8.17	8.35	3.20	11.55	5.63	8.03
1947	9.60	10.65	3.71	14.36	6.94	9.77
1948	11.58	12.43	4.42	16.85	8.02	12.10
1949	12.18	13.26	4.45	17.71	8.50	12.87

[1] Includes value of breeze produced.

YIELD OF COKE PER TON OF COAL

TABLE 27.—Yield of coke from coal in the United States, 1937 and 1947–49, by States, in percent

State	1937		1947		1948		1949	
	Oven coke	Beehive coke	Oven coke	Beehive coke	Oven coke	Beehive coke	Oven coke	Beehive coke
Alabama	72.37	----------	70.88	----------	71.52	----------	70.87	----------
California	----------	----------	61.90	----------	61.53	----------	59.91	----------
Colorado	67.36	55.71	68.15	67.02	69.09	----------	66.61	----------
Illinois	70.54	----------	71.01	----------	70.39	----------	69.61	----------
Indiana	72.04	----------	73.62	----------	72.23	----------	72.17	----------
Maryland	72.62	----------	71.89	----------	71.45	----------	71.83	----------
Massachusetts	69.99	----------	72.45	----------	71.48	----------	70.49	----------
Michigan	71.05	----------	72.32	----------	71.24	----------	71.38	----------
Minnesota	70.27	----------	71.67	----------	71.82	----------	71.17	----------
New Jersey	70.78	----------	72.05	----------	72.13	----------	73.17	----------
New York	71.75	----------	70.27	----------	69.31	----------	69.80	----------
Ohio	71.61	----------	70.88	----------	70.60	----------	70.23	----------
Pennsylvania	68.83	65.50	68.70	64.15	68.73	64.38	68.22	64.53
Tennessee	69.00	53.89	74.23	----------	73.42	----------	69.98	----------
Texas	----------	----------	70.64	----------	70.96	----------	70.09	----------
Utah	56.67	54.26	60.46	53.11	60.78	52.83	61.46	54.29
Virginia	----------	58.33	----------	57.73	----------	58.20	----------	59.78
Washington	56.11	----------	----------	----------	----------	----------	----------	----------
West Virginia	70.67	61.74	69.96	64.74	69.61	64.96	70.42	64.61
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	73.57	----------	73.69	64.94	73.73	62.14	73.47	62.99
United States average	70.73	64.23	70.58	63.84	70.33	63.73	69.98	63.78

PREPARATION AND SOURCE OF COAL

Washed and Unwashed Coal.—The quality of coke produced depends to a much greater degree upon the character and kind of coal carbonized than it does upon the oven design and carbonizing practice. The quality of coking coal varies widely from field to field and even within the same field. The wide adoption of machines to load coal and the decline in availability of the best quality coking coals in recent years have made it necessary to place more emphasis on the

blending and cleaning of the poorer coals in order to produce coke containing the desired chemical and physical qualities. One of the principal advantages of using clean coal is the resulting uniformity in the physical and chemical properties of the coke. Uniformity of coke is considered by blast-furnace operators as one of the most important factors in blast-furnace economy. The necessity for clean coal has resulted in the installation of a number of new cleaning facilities in the past several years, and the quantity of washed coal carbonized has increased steadily. In 1949, 38 percent of the bituminous coal charged into slot-type ovens and 20 percent of the coal for beehive ovens were washed, compared with 29 and 18 percent, respectively, in 1948. Coal cleaning to reduce its ash and sulfur content has been practiced by coke producers (according to available data) since 1890, when only 1 percent was washed. All coal mined and used for the manufacture of coke in Alabama and Colorado in 1949 was washed, most of Tennessee's, Oklahoma's, and about one-third of Pennsylvania's was also washed before being carbonized. Data in table 28 include coal cleaned at the mines by coal producers as well as that cleaned at the coke plants by coke-plant operators. Bituminous coal cleaned at the mines was used by 44 oven- and 7 beehive-coke plants and comprised 78 percent of the washed coal carbonized; the remainder (7,519,390 tons) was washed at 10 coke plants which have cleaning facilities at the ovens.

TABLE 28.—Washed and unwashed coal used in manufacturing coke in the United States in 1949, by States in which used, in net tons

State	Slot-type ovens				Beehive ovens		
	Bituminous		Anthracite	Total	Bituminous		
	Washed	Unwashed			Washed	Unwashed	Total
Alabama	7,066,112	216,345		7,282,457			
California	513,965	64,529		578,494			
Colorado	1,095,247			1,095,247			
Illinois	1,875,690	2,701,004	14,160	4,590,854			
Indiana	3,049,379	7,388,505		10,437,884			
Maryland		2,839,947		2,839,947			
Massachusetts		1,264,638		1,264,638			
Michigan	252,462	3,150,119	77,783	3,480,364			
Minnesota	107,264	984,447	7,007	1,098,718			
New Jersey		1,838,202		1,838,202			
New York	917,223	6,465,307	7,071	7,389,601			
Ohio	5,664,474	7,023,710		12,688,184			
Pennsylvania	9,433,822	12,177,922	35,563	21,647,307	846,818	3,644,964	4,491,782
Tennessee	148,569	156,344		304,913			
Texas	516,660	192,448		709,108			
Utah		1,466,527		1,466,527	218,212	26,589	244,801
Virginia						263,963	263,963
West Virginia	1,235,421	3,270,324	13,782	4,519,527		276,686	276,686
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	771,046	2,033,844	17,459	2,822,349		77,243	77,243
Total	32,647,324	53,234,252	172,825	86,054,401	1,065,030	4,289,465	5,354,495
At merchant plants	2,342,147	14,573,005	45,143	16,960,295			
At furnace plants	30,305,177	38,661,247	127,682	69,094,106			

Sources.—Coal is the lifeblood of the coke ovens, and sources of supply are of paramount importance to the coke producers. The greatest concentration of coking coals in the United States and possibly in the world is found in the Appalachian region, extending from Alabama to Pennsylvania. Roughly 95 percent of all coal used in the United States for the manufacture of oven and beehive coke comes from States within this region. Relatively small deposits of coals suitable for the production of metallurgical coke occur in the Trinidad-Raton field of southern Colorado and northern New Mexico, the Sunnyside beds in the Castle Gate field of Utah, in Haskell and other counties in eastern Oklahoma, in Sebastian County in western Arkansas, and in Pierce and Kittitas Counties in Washington. The best high-volatile and medium-volatile coking coals are found in West Virginia, Pennsylvania, eastern Kentucky, and Alabama. The sources of low-volatile coking coals, which are very important for improving the physical properties of metallurgical coke, especially its strength, come principally from West Virginia and to a considerably lesser extent from central Pennsylvania, eastern Oklahoma, and western Arkansas. Origin and destination of coal used in the manufacture of oven coke are shown in detail in tables 29 and 30.

Many of the coke-producing companies, especially those connected with the iron and steel industry, own or control "captive" mines that supply them with coking coal. Annual reports submitted to the Bureau of Mines by oven-coke plant operators showed that more than 54 percent of the total quantity of coal carbonized in 1949 was obtained from such mines. Oven-coke plants associated with iron and steel works received 69,436,016 tons of coal in 1949, of which 42,432,013 tons, or 61 percent, was obtained from "captive" mines. Nonfurnace coke plants obtained 4,401,461 tons, or 27 percent, of the total receipts of 16,243,708 tons of coal from "captive" mines.

Blending.—As an important part of coal preparation, oven-coke plant operators mix or blend various types of coals before charging into the ovens. In many cases, a better coke can be obtained by a judicious blend of two, three, or more different coals than can be made from any one of the three by itself. Blending has several aims and considers many factors important to the oven-coke plant operators; the primary objective, of course, is to produce, economically, a quality coke satisfactory for the use intended. It also permits the use of coals that have good coking properties but otherwise may be objectionable from the standpoint of excessive ash, sulfur, or phosphorus content and that could not be used alone as a 100-percent charge. Thus, in addition to providing a means of controlling the quality and strength of the coke and the yield of coproducts, blending permits flexible operation at oven-coke plants and use of a wider variety of coking coal. In future, the problem of blending will be much greater, due to a shortage of the most desirable coals.[1]

[1] Savage, Philip S., The Blending of Coal to Improve Coke and Extend Coking Coal Resources: Blast Furnace and Steel Plant, vol. 37, No. 3, Mar. 1949, pp. 323–324 and 334.

Although all oven-coke plants mix or blend coals before charging them into the ovens, the mixing of coal of different volatile content was practiced at 77 oven-coke plants in 1949, of which 47 used high- and low-volatile coal; 25, high-, medium-, and low-; 2, high- and medium-; and 3, low- and medium-volatile. Of the plants that did not blend coals of different volatile content, 5 plants used straight high-volatile and 4, medium-volatile. The proportion of the different kinds of coals mixed before charging into ovens, where practiced, varies widely from plant to plant according to local conditions. Classification of all coal obtained by coke-plant operators in 1949 showed, however, that 65 percent was high-volatile; 12 percent, medium-volatile; and 23 percent, low-volatile.

TABLE 29.—Coal received for manufacturing oven coke in the United States in 1949, by fields of origin

State and district where coal was produced	Quantity received (net tons)	States where coal was consumed, in order of importance
Alabama	7,065,913	Alabama and Texas.
Arkansas	141,930	California, Colorado, Texas, Missouri, Alabama, and Illinois.
Colorado	805,087	Colorado.
Illinois	542,492	Illinois, Indiana, Missouri, and Minnesota.
Indiana	99,392	Illinois, Indiana, and Wisconsin.
Kentucky:		
Elkhorn	5,447,662	Indiana, Michigan, Ohio, New York, Illinois, Pennsylvania, New Jersey, Massachusetts, West Virginia, Wisconsin, and Missouri.
Harlan	5,166,894	Indiana, Illinois, Ohio, Minnesota, Pennsylvania, and New York.
Hazard	70,959	Ohio and Illinois.
Kenova-Thacker	521,656	Ohio, New York, Wisconsin, West Virginia, and Pennsylvania.
Southern Appalachian	108,844	Tennessee, New York, and Ohio.
Maryland	652	Pennsylvania.
New Mexico	254,075	Colorado and California.
Oklahoma	841,956	Texas, Utah, Colorado, Alabama, and Illinois.
Pennsylvania:		
Anthracite	181,263	Michigan, Pennsylvania, Illinois, West Virginia, Missouri, Minnesota, and New York.
Bituminous:		
Central Pennsylvania:		
High-volatile	329,736	New York and West Virginia.
Medium-volatile	487,627	New York and Pennsylvania.
Low-volatile	2,729,286	Pennsylvania, New York, Maryland, and Ohio.
Connellsville	13,259,557	Pennsylvania, Ohio, West Virginia, New York, Minnesota, and Maryland.
Freeport	2,222,161	West Virginia, Ohio, Michigan, and New York.
Pittsburgh	7,289,906	Pennsylvania, Ohio, New York, West Virginia, Michigan, Connecticut, Indiana, and Illinois.
Somerset	636,503	Pennsylvania, West Virginia, New York, and Maryland.
Westmoreland	235,899	Pennsylvania, New York, and Wisconsin.
Tennessee	155,369	Tennessee, New York, and Illinois.
Utah	1,817,285	Utah and California.
Virginia:		
Clinch Valley	924,297	Michigan, Ohio, New York, Illinois, Indiana, Massachusetts, Wisconsin, Maryland, and Rhode Island.
Pocahontas	1,006,961	Indiana and New York.
Southwestern	597,589	New York, New Jersey, Pennsylvania, Missouri, Connecticut, Ohio, Illinois, Alabama, West Virginia, and Massachusetts.
West Virginia:		
Coal River	93,782	Connecticut, Massachusetts, and West Virginia.
Fairmont	6,211,668	Pennsylvania, Maryland, West Virginia, New York, Michigan, Ohio, and Massachusetts.
Kanawha	5,868,004	Ohio, Kentucky, Pennsylvania, Indiana, Massachusetts, West Virginia, Illinois, New Jersey, Minnesota, Connecticut, New York, Rhode Island, Michigan, Wisconsin, and Missouri.
Kenova-Thacker	208,254	Ohio, Connecticut, West Virginia, and New York.
Logan	3,208,591	Indiana, Ohio, Pennsylvania, New Jersey, New York, Illinois, Wisconsin, Massachusetts, West Virginia, Connecticut, Michigan, and Kentucky.
New River:		
High-volatile	726,782	New York, New Jersey, Rhode Island, Pennsylvania, Michigan, Massachusetts, and Wisconsin.
Medium-volatile	168,832	Ohio.
Low-volatile	263,772	Maryland, Michigan, Pennsylvania, Ohio, and Rhode Island.
Panhandle	148,414	Pennsylvania and New York.
Pocahontas	11,[illegible],655	Indiana, Ohio, Illinois, Pennsylvania, Michigan, New York, Minnesota, West Virginia, Maryland, Wisconsin, Kentucky, Alabama, Connecticut, Missouri, Tennessee, Massachusetts, and Rhode Island.
Preston-Taylor	94,348	West Virginia, Pennsylvania, New York, and Connecticut.
Randolph-Barbour	674,368	Pennsylvania, Ohio, Minnesota, and New York.
Tug River	267,868	Maryland, Kentucky, New York, West Virginia, Massachusetts, Indiana, and Illinois.
Webster-Gauley	1,[illegible]	Pennsylvania, New York, Ohio, Maryland, and Illinois.
Winding Gulf	1,[illegible],415	New Jersey, Ohio, Massachusetts, Michigan, New York, Rhode Island, West Virginia, Illinois, Indiana, Kentucky, and Connecticut.
Total	[illegible]	

TABLE 80.—Coal received for manufacturing oven coke in the United States in 1949, by States where produced and where consumed and by merchant and furnace plants, in net tons

State where coal was consumed	Coal produced in—														
	Alabama	Arkansas	Colorado	Illinois	Indiana	Kentucky	Maryland	New Mexico	Oklahoma	Pennsylvania	Tennessee	Utah	Virginia	West Virginia	Total
Alabama:															
Merchant plants	844,908	4,163											3,820	117,634	970,525
Furnace plants	6,119,013	2,861							2,862					10,689	6,135,425
Total Alabama	6,963,921	7,024							2,862				3,820	128,323	7,105,950
California: Furnace plant		64,661						27,551				508,418			600,630
Colorado: Furnace plant		47,849	805,087					326,524	79,724						1,259,184
Illinois:															
Merchant plants						63,148				28,179	1,149		1,329	408,473	502,278
Furnace plants		4,833		274,033	78,283	1,720,992			1,451	1,473			71,079	1,674,107	3,826,251
Total Illinois		4,833		274,033	78,283	1,784,140			1,451	29,652	1,149		72,408	2,172,580	4,418,529
Indiana:															
Merchant plants					12,148								58,165	932,856	1,003,169
Furnace plants				256,661		4,238,577				1,872			959,028	3,974,459	9,430,597
Total Indiana				256,661	12,148	4,238,577				1,872			1,017,193	4,907,315	10,433,766
Maryland: Furnace plant										447,164			16,130	2,467,954	2,931,248
Massachusetts: Merchant plants						84,449							54,953	1,119,513	1,258,915
Michigan:															
Merchant plants										228,594			152,134	479,741	860,469
Furnace plants						1,117,839				314,767			197,796	857,627	2,488,029
Total Michigan						1,117,839				543,361			349,930	1,337,368	3,348,498
Minnesota:															
Merchant plant				189						7,041				279,383	286,613
Furnace plants						424,170				11,721				285,569	721,460
Total Minnesota				189		424,170				18,762				564,952	1,008,073
New Jersey: Merchant plants						164,131							179,409	1,378,711	1,722,251
New York:															
Merchant plants						369,629				1,313,833			188,074	1,668,269	3,539,805
Furnace plants						327,315				1,924,928	5,651		174,525	901,901	3,334,320
Total New York						696,944				3,238,761	5,651		362,599	2,570,170	6,874,125

Ohio:															
Merchant plants						224,237							213,811	1,180,296	1,618,374
Furnace plants						2,018,489				4,152,054			69,963	4,773,193	11,013,699
Total Ohio						2,242,726				4,152,054			283,801	5,953,489	12,632,073
Pennsylvania:															
Merchant plants										12,328			88,562	658,632	759,522
Furnace plants						388,606	652			16,431,184				4,974,412	21,794,854
Total Pennsylvania						388,606	652			16,443,512			88,562	5,633,044	22,554,376
Tennessee: Furnace plant						90,314					148,569			18,795	257,678
Texas: Furnace plants	101,992	9,260							600,259						711,511
Utah: Furnace plants									157,660			1,308,867			1,466,527
West Virginia:															
Merchant plants														978,460	978,460
Furnace plants						40,174				2,471,127			2,694	950,608	3,464,603
Total West Virginia						40,174				2,471,127			2,694	1,929,068	4,443,063
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin: Merchant plants		8,303		11,609	8,961	43,945				25,673			97,345	2,457,491	2,653,327
Grand total	7,066,913	141,930	805,087	542,492	99,392	11,316,015	652	354,075	841,956	27,371,938	155,369	1,817,285	2,528,847	32,638,773	85,679,724
At merchant plants	844,908	12,466		11,798	21,109	949,539				1,615,648	1,149		1,037,632	11,749,459	16,243,708
At furnace plants	6,221,005	129,464	805,087	530,694	78,283	10,366,476	652	354,075	841,956	25,756,290	154,220	1,817,285	1,491,215	20,889,314	69,436,016

TABLE 31.—Coal received for manufacturing oven coke in the United States in 1949, by States where consumed and by volatile content [1]

State where coal was consumed	High-volatile		Medium-volatile		Low-volatile		Total coal received (net tons)
	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total	
Alabama:							
Merchant plants	102,228	10.5	746,500	76.9	121,797	12.6	970,525
Furnace plants	405,512	6.6	5,719,224	93.2	10,689	.2	6,135,425
Total Alabama	507,740	7.1	6,465,724	91.0	132,486	1.9	7,105,950
California: Furnace plant	535,969	89.2			64,661	10.8	600,630
Colorado: Furnace plant	1,131,611	89.9			127,573	10.1	1,259,184
Illinois:							
Merchant plants	103,093	17.4	245,806	41.5	243,379	41.1	592,278
Furnace plants	2,694,571	70.4			1,131,680	29.6	3,826,251
Total Illinois	2,797,664	63.2	245,806	5.7	1,375,059	31.1	4,418,529
Indiana:							
Merchant plants	527,812	52.6	86,813	8.7	388,544	38.7	1,003,169
Furnace plants	5,071,690	53.8			4,358,907	46.2	9,430,597
Total Indiana	5,599,502	53.7	86,813	.8	4,747,451	45.5	10,433,766
Maryland: Furnace plant	1,956,690	66.8			974,558	33.2	2,931,248
Massachusetts: Merchant plants	773,894	61.5	244,763	19.4	240,258	19.1	1,258,915
Michigan:							
Merchant plants	228,594	26.6	274,428	31.9	357,447	41.5	860,469
Furnace plants	1,943,486	78.1			544,543	21.9	2,488,029
Total Michigan	2,172,080	64.9	274,428	8.2	901,990	26.9	3,348,498
Minnesota:							
Merchant plant	188,130	65.6			98,483	34.4	286,613
Furnace plants	435,891	60.4	14,479	2.0	271,090	37.6	721,460
Total Minnesota	624,021	61.9	14,479	1.4	369,573	36.7	1,008,073
New Jersey: Merchant plants	898,136	52.1	464,994	27.0	359,121	20.9	1,722,251
New York:							
Merchant plants	2,457,813	69.4	612,736	17.3	469,256	13.3	3,539,805
Furnace plants	1,748,713	52.5	407,646	12.2	1,177,961	35.3	3,334,320
Total New York	4,206,526	61.2	1,020,382	14.8	1,647,217	24.0	6,874,125
Ohio:							
Merchant plants	966,887	59.7	139,978	8.7	511,509	31.6	1,618,374
Furnace plants	7,228,759	65.6	307,237	2.8	3,477,703	31.6	11,013,699
Total Ohio	8,195,646	64.9	447,215	3.5	3,989,212	31.6	12,632,073
Pennsylvania:							
Merchant plants	316,777	41.7	319,957	42.1	122,788	16.2	759,522
Furnace plants	18,425,515	84.5	564,141	2.6	2,805,198	12.9	21,794,854
Total Pennsylvania	18,742,292	83.1	884,098	3.9	2,927,986	13.0	22,554,376
Tennessee: Furnace plant	90,314	35.0	148,569	57.7	18,795	7.3	257,678
Texas: Furnace plants	429,036	60.3	198,931	28.0	83,544	11.7	711,511
Utah: Furnace plants	1,308,867	89.2			157,660	10.8	1,466,527
West Virginia:							
Merchant plants	978,460	100.0					978,460
Furnace plants	2,923,987	84.4	21,215	.6	519,401	15.0	3,464,603
Total West Virginia	3,902,447	87.8	21,215	.5	519,401	11.7	4,443,063
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin: Merchant plants	1,785,589	67.3	154,100	5.8	713,638	26.9	2,653,327
Grand total	55,658,025	65.0	10,671,526	12.4	19,250,173	22.6	85,579,724
At merchant plants	9,327,414	57.4	3,290,084	20.3	3,626,290	22.3	16,243,788
At furnace plants	46,330,611	66.7	7,381,442	10.6	15,723,963	22.7	69,436,016

[1] High-volatile—dry volatile matter more than 31 percent; medium-volatile—dry volatile matter 31 percent or less and more than 22 percent; low-volatile—dry volatile matter 22 percent or less and more than 14 percent.

COKE BREEZE

TABLE 32.—Coke breeze recovered at coke plants in the United States in 1949, by States

State	Yield per ton of coal [1] (percent)	Produced: Net tons	Produced: Value	Used by producer—For steam raising: Net tons	Used by producer—For steam raising: Value	Used by producer—For other purposes (including water gas): Net tons	Used by producer—For other purposes (including water gas): Value	Sold: Net tons	Sold: Value	Wasted (net tons)	On hand Dec. 31 (net tons)
Oven coke:											
Alabama	4.00	291,361	$1,602,095	102,369	$433,253	60,387	$321,875	141,248	$908,644		21,809
California	6.68	38,363	(2)			27,716	(2)	7,479	(2)	3,168	36,247
Colorado	6.80	74,518	(2)	10,039	(2)	36,868	(2)	24,432	(2)		3,743
Illinois	6.44	295,538	851,805	150,315	368,401	22,809	88,713	104,504	362,440	7,464	112,715
Indiana	6.12	638,765	1,689,697	329,012	850,896	148,726	343,884	117,003	880,956		136,895
Maryland	7.00	198,737	(2)	179,409	(2)	28,103	(2)	35,781	(2)		248,657
Massachusetts	8.07	102,054	(2)	83,349	(2)	2,483	(2)	2,843	(2)		21,997
Michigan	6.76	235,112	728,186	143,667	391,860	26,528	84,124	106,557	351,727		17,643
Minnesota	6.37	69,966	274,158	39,390	138,842	7,809	(2)	36,570	(2)		32,357
New Jersey	5.01	92,095	(2)	82,673	(2)			39	(2)		10,699
New York	5.83	481,151	2,195,756	294,889	1,526,771	141,481	724,412	21,238	78,714		46,416
Ohio	5.85	742,566	2,648,606	446,151	1,616,980	185,353	550,583	153,385	609,931	9,350	137,267
Pennsylvania	5.47	1,188,872	3,088,918	1,017,879	2,879,492	62,428	167,564	160,468	407,273		529,967
Tennessee	2.96	9,085	(2)	6,292	(2)			530	(2)		3,466
Texas	3.78	26,789	(2)			9,074	(2)	42,288	(2)		267
Utah	9.55	140,016	(2)	39,528	(2)	33,631	(2)	60,665	(2)		28,780
West Virginia	4.75	193,110	491,245	133,194	341,633	45,348	119,720	20,247	47,627		26,576
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5.90	166,538	655,692	140,945	532,536			20,182	102,124		18,799
Undistributed			2,708,854		1,675,129		513,784		856,578		
Total 1949	5.76	4,929,086	16,985,002	3,199,101	10,550,793	838,744	2,914,659	1,055,459	4,106,014	19,982	1,433,289
At merchant plants	5.95	982,492	4,587,645	718,295	3,132,708	117,269	618,076	133,707	755,489	1,993	142,248
At furnace plants	5.71	3,946,594	12,397,357	2,480,806	7,418,085	721,475	2,296,583	921,752	3,350,525	17,989	1,291,041
Total 1948	5.93	5,765,576	20,017,861	3,625,109	11,829,909	920,767	3,203,649	1,121,611	4,612,058	20,432	1,485,710
Beehive coke:											
Pennsylvania	2.39	34,724	71,453	1,141	4,704			19,261	36,431	11,905	4,511
Utah	5.83	14,288	(2)					7,744	(3)	3,743	2,796
Virginia	.01	9	(2)			9	(3)				20
West Virginia	3.91	10,473	14,798					8,526	(2)	1,952	
Undistributed			43,185						32,021		
Total 1949	2.89	59,494	129,436	1,141	4,704	9	(3)	35,531	68,452	[4] 17,600	7,327

[1] Computed by dividing production of breeze by coal charged at plants actually recovering.
[2] Included with "Undistributed."
[3] Not at liberty to publish.
[4] As reported; quantity produced but not used was undoubtedly greater. See Mineral Resources of the United States, 1922, pt. II, pp. 726–727.

SHIPMENTS BY RAIL, WATER, AND TRUCK

Table 33 shows, by method of movement, the quantity of coke and breeze shipped outside the producing plants in 1949. In the oven-coke industry the bulk of the coke produced is consumed in integrated metallurgical operations and therefore does not leave the producing establishments. For example, total shipments of oven coke in 1949 amounted to 37 percent of the total output. Railroads transported 89 percent of all oven-coke shipments; trucks, 4 percent; and boats, 7 percent. Nearly all beehive ovens are located at the coal mines; consequently, the coke must be loaded for shipment to points of consumption. In 1949, shipments of beehive coke totaled 3,323,682 tons, equivalent to 98 percent of the total beehive output. Railroads transported virtually all of the beehive coke shipped, as less than 1 percent moved by truck. No beehive coke was reported as moving on waterways in 1949, as the closing of the Weirton Coal Co.'s Isabella beehive plant in 1948 removed the last beehive plant that transported coke by barges.

TABLE 33.—Coke and breeze sold and loaded at plants in the United States for shipment in 1949, in net tons

State	Coke				Breeze			
	In railroad cars	In boats	In trucks	Total	In railroad cars	In boats	In trucks	Total
Oven coke:								
Alabama	861,038		7,243	868,281	141,248			141,248
California	1,442		457	1,899	7,148		331	7,479
Colorado	45,075		991	46,066	24,373		59	24,432
Illinois	1,599,775		14,276	1,614,051	101,864	571	2,069	104,504
Indiana	1,964,265		56,903	2,021,168	116,866		137	117,003
Maryland					5,474	30,307		35,781
Massachusetts	382,856	24,503	323,403	730,762	54		2,789	2,843
Michigan	812,140	101,770	83,002	996,912	69,131	35,519	1,907	106,557
Minnesota	229,967		9,900	239,977	36,569		1	36,570
New Jersey	596,379	279,032	192,695	1,068,106			39	39
New York	1,885,665	103,241	365,735	2,354,641	17,282	2,195	1,761	21,238
Ohio	1,977,132	120,903	72,639	2,170,674	143,857	7,381	2,147	153,385
Pennsylvania	6,546,000	211,501	136,682	6,894,183	122,762	36,754	952	160,468
Tennessee	90,461			90,461	530			530
Texas	98,371			98,371	42,288			42,288
Utah	67,768		7,783	75,551	60,665			60,665
West Virginia	1,395,665		455	1,396,120	20,247			20,247
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,474,624	61,763	277,863	1,814,250	14,387		5,795	20,182
Total	20,028,843	902,713	1,550,117	22,481,473	924,745	112,727	17,987	1,055,459
At merchant plants	7,797,454	527,140	1,353,293	9,677,887	104,609	16,237	12,861	133,707
At furnace plants	12,231,189	375,573	196,824	12,803,586	820,136	96,490	5,126	921,752
Beehive coke:								
Kentucky	48,583			48,583				
Pennsylvania	2,851,883		9,806	2,861,689	19,261			19,261
Utah	76,960		28	76,988	7,744			7,744
Virginia	157,397		385	157,782				
West Virginia	175,670			175,670	1,074		7,452	8,526
Total	3,312,483		10,219	3,322,683	28,079		7,452	35,531

TABLE 34.—Beehive coke loaded for shipment on originating railroads, waterways, and trucks in the United States in 1949, by routes, as reported by producers

Route	Producing State	Net tons		Percent of total
		By States	Total	
Railroads:				
Baltimore & Ohio	Pennsylvania	611,149	726,744	21.9
	West Virginia	115,595		
Chesapeake & Ohio	Kentucky	48,583	66,221	2.0
	West Virginia	17,638		
Denver & Rio Grande Western	Utah	76,969	76,969	2.3
Interstate	Virginia	137,467	137,467	4.1
Louisville & Nashville	do	900	900	(1)
Monongahela	Pennsylvania	720,429	720,429	21.7
New York Central	West Virginia	37,571	37,571	1.1
Norfolk & Western	Virginia	19,000	19,000	.6
Pennsylvania	Pennsylvania	1,454,571	1,454,571	43.8
Pittsburgh & Lake Erie	do	65,714	65,714	2.0
Western Maryland	West Virginia	7,866	7,866	.2
Total railroad shipments		3,313,452	3,313,452	99.7
Waterways				
Trucks	(2)	10,230	10,230	.3
Grand total		3,323,682	3,323,682	100.0

[1] Less than 0.05 percent.
[2] Pennsylvania, Utah, and Virginia

DISTRIBUTION OF OVEN AND BEEHIVE COKE

Table 35 shows the quantity of coke and coke breeze distributed to each State in 1949, with a breakdown of the large coke according to principal end uses. Detailed statistics on this subject will be published and distributed by the Bureau of Mines in the form of a mineral market report.

The total quantity of coke distributed to consumers in 1949 was 63,462,233 tons, a 15-percent decline from the record movement in 1948. Deliveries to blast furnaces within the United States comprised 82 percent of the total shipments of all large coke; foundries received 4 percent, producer-gas and water-gas manufacturers 7 percent, other industrial purposes 3 percent, and residential or household heating 4 percent. Pennsylvania was the largest user of coke, with 25 percent of the total, followed by Ohio and Indiana, with 16 and 10 percent, respectively. Furnace coke was used in 18 States in 1949; however, 76 percent of the total was used by 5 States—Pennsylvania, Ohio, Indiana, Illinois, and Alabama. Coke for foundry use was shipped to all States. Coke was used for the manufacture of producer gas in 8 States and for producing water gas in 27. The consumption of coke for other industrial purposes is widespread, and all but one State used coke for miscellaneous industrial purposes. Coke for residential and commercial heating has been declining rapidly in recent years because of competition from oil and gas and also because of the demand for industrial coke.

TABLE 35.—Oven and beehive coke and breeze distributed to each State in 1949, in net tons

[Based upon reports from all United States producers showing destination of coke used by producer or sold in 1949. Does not include imported coke, which totaled 277,507 tons in 1949]

Consuming State	Coke							Coke breeze
	Furnace use	Foundry use	Making producer gas	Making water gas	Other industrial use	Domestic use	Total	
Alabama	4,309,125	186,594			147,970	37,003	4,680,692	193,547
Arizona		5,407			568		5,975	
Arkansas		2,201			1,188		3,389	95
California	387,911	55,049			38,610		481,570	35,565
Colorado	698,195	12,692			19,004	428	730,319	71,339
Connecticut		42,056	74,318	118,904	11,370	102,529	349,177	39,846
Delaware		2,211		96	213	481	3,001	5,275
District of Columbia		129			30		159	
Florida		1,506		35,009	1,692	1,277	39,484	13,439
Georgia		13,635		6,519	5,783	14,384	40,321	
Idaho		369			2,875	48	3,292	8,721
Illinois	4,365,368	243,649		2,492	128,225	184,843	4,924,577	281,209
Indiana	5,575,986	144,554	15,106	40,673	118,853	138,823	6,033,995	550,976
Iowa		77,709			29,562	3,308	110,579	10,851
Kansas		11,680			2,492		14,172	
Kentucky	501,400	31,281		91,228	33,364	30,002	687,275	76,956
Louisiana		4,778		1,695	45,686	1,486	53,645	542
Maine		5,297		11,260	420	16,222	33,199	
Maryland	2,536,610	33,377		8,006	39,744	1,353	2,619,090	229,805
Massachusetts	147,420	55,116	116,816	204,819	12,017	384,543	920,731	89,014
Michigan	1,359,709	498,115			238,463	253,074	2,349,361	222,752
Minnesota	465,338	33,781		8,834	23,986	99,987	631,926	83,769
Mississippi		771			222	349	1,342	56
Missouri		61,869		5,447	31,911	13,997	113,224	5,483
Montana		1,984			11,727		13,711	28,611
Nebraska		3,441			2,414	266	6,121	5,282
Nevada		26			3,889		3,915	
New Hampshire		3,917		1,294	402	19,902	25,515	
New Jersey		88,238	112,861	357,965	92,874	280,906	932,634	107,279
New Mexico		438			898		1,336	
New York	3,075,640	113,751	303,142	984,862	244,450	599,911	5,321,756	475,198
North Carolina		12,879		1,889	3,275	4,558	22,671	168
North Dakota		324			193	352	869	
Ohio	9,438,975	304,782		298,513	164,743	131,625	10,329,648	735,801
Oklahoma		4,145			162		4,307	40,887
Oregon		4,262			6,820		11,082	2,271
Pennsylvania	15,397,215	254,399	57,196	118,785	191,684	107,767	16,127,046	1,262,139
Rhode Island		11,671	37,067	16,410	1,062	59,756	125,966	21,712
South Carolina		4,406		1,498	5,150	2,434	13,582	2,546
South Dakota		363				556	919	
Tennessee	107,423	58,043		42	103,540	6,516	275,564	110,540
Texas	441,585	31,410		136	13,361	912	487,404	34,915
Utah	885,911	11,208			48,363	4,920	950,402	84,991
Vermont		2,706		2,455	971	8,896	15,028	
Virginia	127,900	41,868		317,288	67,335	1,461	555,852	91
Washington		7,246			5,538		12,784	9,095
West Virginia	1,694,204	34,128		740,536	39,199	101	2,508,168	193,323
Wisconsin		143,464	54,804	29,455	22,227	180,844	430,795	63,759
Wyoming		86			1,212		1,298	
Total	51,415,915	2,653,306	790,910	3,407,671	2,076,746	2,665,820	63,009,788	5,087,848
Exported	98,938	125,562		10,048	127,297	90,020	452,465	42,137
Grand total	51,514,853	2,778,868	790,910	3,417,719	2,204,043	2,755,840	63,462,223	5,129,985

CONSUMPTION OF COKE

The indicated consumption of coke in the United States in 1949 declined 14 percent from the record established in 1948 owing largely to work stoppages in the bituminous-coal and iron and steel industries. The indicated consumption, as calculated by the Bureau of Mines, allows for imports, exports, and changes in producers' stocks but does not take into account stocks held by consumers. However, as con-

sumers' stocks seldom vary widely from year to year, the indicated consumption of coke is a good barometer of the industrial activity of the country, as approximately 95 percent of the total production each year is used for industrial purposes. The principal branch of coke consumption is the smelting of iron ores in blast furnaces, which in the past 10 years have utilized between 70 and 80 percent of the annual output. One of the features in the consumption of coke in blast furnaces in 1949 was the improvement in their fuel efficiency. According to data compiled by the American Iron and Steel Institute, the quantity of coke required to produce 1 net ton of pig iron (including ferro-alloys) declined 41.4 pounds, or 2 percent, from the 1948 figure. This improvement could be attributed to several factors, among which was improvement in the quality of coking coal used in the manufacture of coke in 1949. Fuel efficiency should continue to improve in future because of technologic advancements in blast-furnace practice, better selection of coal, and the construction of more coal-preparation plants. The quantity of coke consumed for all other purposes (in foundries, nonferrous smelting, chemical processes, manufacture of producer gas and water gas, and residential heating) dropped 19 percent from 1948. This was due largely to a sharp reduction in foundry-coke requirements and to further curtailment in sales of coke for residential heating.

Statistics on the disposal, by major uses, of oven and beehive coke, as reported by producers, are given in tables 38 and 39. These data show the extent of the markets for coke and the magnitude of the iron and steel industry, the largest individual consumer. The proportion of oven coke reported by producers as used in integrated blast-furnace operations and sales to financially affiliated companies for blast-furnace use amounted to 76 percent of the total output in 1949. Even this high percentage does not indicate the full extent of the interrelationship of the oven-coke and steel industries, as 80 percent of all oven coke produced in 1949 was made in ovens owned and operated by steel companies. On the other hand, the nonfurnace or merchant oven-coke plants supply the bulk of the coke used for all other industrial purposes, as well as that used for residential heating. In 1949, merchant oven-coke plants supplied 83 percent of foundry-coke shipments, 87 percent of the coke classified as "other industrial," and 82 percent of the total sales for residential heating.

TABLE 36.—Coke consumed in manufacture of pig iron and for other purposes in the United States, 1913, 1918, 1937, and 1947–49, in net tons

Year	Total production	Imports	Exports	Net change in stocks	Indicated United States consumption [1]	Consumed by iron furnaces [2]		Remainder consumed in other ways	
						Quantity	Percent	Quantity	Percent
1913	46,299,530	101,212	987,395	(3)	45,413,347	37,192,287	81.9	8,221,060	18.1
1918	56,478,373	30,168	1,687,824	(3)	54,820,716	45,703,594	83.4	9,117,122	16.6
1937	52,375,469	394,364	526,683	+963,221	51,271,929	37,599,911	73.3	13,672,018	26.7
1947	73,445,880	104,668	836,059	+103,471	72,611,413	57,147,644	78.7	15,463,769	21.3
1948	74,861,938	161,490	[4] 706,783	+561,204	73,755,342	59,126,129	80.2	14,629,213	19.8
1949	63,637,439	277,807	548,356	+176,015	63,190,885	51,356,617	81.3	11,834,268	18.7

[1] Production plus imports minus exports, plus or minus net changes in stocks.
[2] American Iron and Steel Institute; figures include coke consumed in manufacture of ferro-alloys.
[3] Data not available.
[4] Revised figure.

TABLE 37.—Coke and coking coal consumed per net ton of pig iron made in the United States, 1913, 1918, 1937, and 1947–49

Year	Coke per net ton of pig iron and ferro-alloys [1] (pounds)	Yield of coke from coal (percent)	Coking coal per net ton of pig iron and ferro-alloys (pounds calculated)	Year	Coke per net ton of pig iron and ferro-alloys [1] (pounds)	Yield of coke from coal (percent)	Coking coal per net ton of pig iron and ferro-alloys (pounds calculated)
1913	2,172.6	66.9	3,247.5	1947	1,926.0	69.9	2,755.4
1918	2,120.7	66.4	3,193.8	1948	1,937.2	69.6	2,783.3
1937	1,830.6	70.3	2,604.0	1949	1,895.8	70.0	2,708.3

[1] American Iron and Steel Institute; consumption per ton of pig iron only, excluding furnaces making ferro-alloys, was 2,172.6 pounds in 1913, 2,120.7 in 1918, 1,806.7 in 1937, 1,900.0 in 1947, 1,906.0 in 1948, and 1,870.04 in 1949.

TABLE 38.—Oven coke produced and sold or used by producer in the United States in 1949, by States

[Exclusive of screenings or breeze]

State	Produced		Used by producer: In blast furnaces		Used by producer: For other purposes [1]		Sold: Furnace [2]	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Alabama	5,161,397	$55,493,394	4,232,386	$41,241,209	18,596	$184,262	79,635	$1,011,548
California	346,552	(3)	352,789	(3)	292	(3)	----------	----------
Colorado	729,516	(3)	683,418	(3)	2,641	(3)	----------	----------
Illinois	3,195,645	52,258,356	1,595,608	24,866,933	6,381	87,195	1,185,752	20,344,401
Indiana	7,533,290	122,587,774	5,480,521	86,889,062	100,140	1,402,601	1,402,361	24,490,100
Maryland	2,039,967	(3)	2,049,692	(3)	4,739	(3)	----------	----------
Massachusetts	891,400	(3)	----------	----------	134,359	(3)	147,362	(3)
Michigan	2,484,409	34,773,316	1,320,388	(3)	146,314	2,116,448	156,534	(3)
Minnesota	781,943	12,693,928	482,895	(3)	14,519	190,977	31,570	(3)
New Jersey	1,345,094	(3)	----------	----------	232,318	(3)	194,904	(3)
New York	5,164,790	69,074,052	1,669,058	(3)	1,130,830	14,309,937	1,425,504	17,890,311
Ohio	8,911,140	111,443,394	6,744,098	82,380,242	71,755	971,318	1,056,436	13,333,875
Pennsylvania	14,768,809	179,836,346	7,711,693	92,045,360	144,792	1,692,504	6,272,123	76,069,401
Tennessee	213,378	(3)	197,428	(3)	14,944	(3)	----------	----------
Texas	497,019	(3)	404,453	(3)	38	(3)	66,424	(3)
Utah	991,829	(3)	820,581	(3)	3,061	(3)	----------	----------
West Virginia	3,182,857	34,370,765	1,441,389	19,207,454	334,851	2,679,047	939,767	7,908,718
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	2,073,456	29,838,358	----------	----------	180,798	2,059,993	648,966	7,426,924
Undistributed	----------	96,480,388	----------	105,350,770	----------	5,127,017	----------	8,681,538
Total 1949	60,222,481	798,792,069	35,046,393	451,981,030	2,541,388	30,811,299	13,607,428	177,246,816
At merchant plants	12,112,922	181,084,964	----------	----------	2,188,504	26,881,443	2,217,394	32,439,133
At furnace plants	48,109,559	617,707,106	35,046,393	451,981,030	352,884	3,929,856	11,390,034	144,807,683
Total 1948	68,284,357	848,719,083	38,996,137	486,383,833	2,817,193	30,999,229	14,968,206	181,311,835

See footnotes at end of table.

TABLE 38.—Oven coke produced and sold or used by producer in the United States in 1949, by States—Continued

State	Sold—Continued							
	Foundry [4]		Other industrial (including water gas) [5]		Domestic		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Alabama	411,156	$7,269,798	283,184	$4,424,070	94,306	$965,475	868,281	$13,670,891
California			1,899	(3)			1,899	(3)
Colorado	3,832	(3)	41,806	(3)	428	(3)	46,066	(3)
Illinois	243,080	4,976,474	80,607	1,019,535	104,612	1,325,950	1,614,051	27,666,360
Indiana	393,448	(3)	75,725	(3)	149,634	1,640,955	2,021,168	35,233,667
Maryland								
Massachusetts	63,840	(3)	182,951	(3)	336,609	(3)	730,762	(3)
Michigan	371,826	(3)	190,317	2,204,060	278,235	3,551,210	996,912	15,168,089
Minnesota	100,457	(3)	24,476	(3)	83,474	(3)	239,977	(3)
New Jersey	48,031	(3)	504,794	(3)	320,377	(3)	1,068,106	(3)
New York	28,190	(3)	379,339	(3)	521,518	7,115,342	2,354,641	30,936,885
Ohio	229,116	4,190,291	741,275	9,755,690	143,847	1,676,111	2,170,674	28,955,967
Pennsylvania	202,945	4,130,128	225,136	3,233,458	193,979	2,263,984	6,894,183	85,696,971
Tennessee	25,913	(3)	64,548	(3)			90,461	(3)
Texas	12,718	(3)	19,229	(3)			98,371	(3)
Utah			70,583	(3)	4,968	(3)	75,551	(3)
West Virginia	10,697	189,324	382,964	3,763,423	62,692	451,531	1,396,120	12,402,996
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	353,344	7,163,106	365,632	5,417,539	446,308	6,552,221	1,814,250	26,569,790
Undistributed		21,480,945		20,017,635		11,471,993		37,205,448
Total 1949	2,498,593	49,400,066	3,634,465	49,835,410	2,740,987	37,014,772	22,481,473	313,497,064
At merchant plants	2,134,965	42,449,274	3,090,606	43,474,516	2,234,922	31,905,157	9,677,887	150,268,080
At furnace plants	363,628	6,950,792	543,859	6,360,894	506,065	5,109,615	12,803,586	163,228,984
Total 1948	3,162,237	59,612,136	4,326,178	57,781,721	3,398,696	44,759,620	25,845,317	343,465,312

[1] Comprises 80,395 tons valued at $1,230,026 used in foundries; 790,910 tons, $9,538,902 to make producer gas; 1,313,785 tons, $16,167,896 to make water gas; and 256,298 tons, $3,574,475 for other purposes.

[2] Includes 10,656,809 tons valued at $135,672,369 sold to financially affiliated companies.

[3] Included with "Undistributed."

[4] Includes 52,433 tons valued at $1,158,472 sold to financially affiliated companies.

[5] Includes 721,076 tons valued at $9,867,867 for manufacture of water gas and 192,713 tons, $2,573,912 for other industrial use sold to financially affiliated companies; and 1,267,895 tons, $17,135,440 for manufacture of water gas sold to other consumers.

Insufficient oven-coke capacity by the iron and steel industry has made it necessary for several of the large steel companies to lease and operate beehive-coke ovens to augment their supplies of blast-furnace coke. For example, in 1943, when beehive-coke production reached its wartime peak, the quantity used by producers or sold to financially affiliated companies for blast-furnace use represented about 26 percent of the total output. In 1949, however, the proportion of furnace coke used by the producers or sold to affiliated interests had risen to 34 percent. Total shipments of beehive coke to blast furnaces amounted to 84 percent of the total deliveries, iron foundries received 6 percent, other industrial (including water-gas manufacture) 9 percent, and residential heating less than 1 percent.

TABLE 39.—Beehive coke produced and sold or used by producer in the United States in 1949, by States

State	Produced		Used by producer— In blast furnaces		Used by producer— For other purposes		Sold— Furnace [1]	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Kentucky	48,583	(2)					21,748	(2)
Pennsylvania	2,898,683	$36,367,550	11,145	(2)	1,735	(2)	2,515,427	$30,992,772
Utah	132,762	(2)	56,373	(2)			75,315	(2)
Virginia	157,812	2,300,193					77,897	1,138,123
West Virginia	177,108	2,535,415			44	(2)	103,127	1,403,360
Undistributed		2,742,469		$1,137,134		$25,102		1,370,665
Total: 1949	3,414,948	43,945,627	67,518	1,137,134	1,779	25,102	2,793,514	34,904,920
1948	6,577,571	79,562,771	261,789	4,109,360	3,160	39,225	5,070,374	58,033,929

Sold—Continued

State	Foundry		Other industrial (including water gas) [3]		Domestic		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Kentucky			26,835	(2)			48,583	(2)
Pennsylvania	162,595	$2,428,822	169,606	$2,230,159	14,041	$163,953	2,861,669	$35,815,706
Utah	335	(2)	1,348	(2)			76,998	(2)
Virginia	16,656	(2)	62,515	892,734	694	(2)	157,762	2,299,456
West Virginia	20,294	(2)	55,131	793,749	118	(2)	178,670	2,556,442
Undistributed		621,570		407,777		11,316		1,783,396
Total: 1949	199,880	3,050,392	315,435	4,324,419	14,853	175,269	3,323,682	42,455,000
1948	496,752	7,462,338	678,521	9,064,943	46,613	553,744	6,292,260	75,134,954

[1] Includes 1,094,907 tons valued at $12,324,470 sold to financially affiliated companies for blast-furnace use.
[2] Included with "Undistributed."
[3] Includes 554 tons valued at $8,045 sold to financially affiliated companies for other industrial use and 114,973 tons, $1,609,798 for manufacture of water gas sold to other consumers.

STOCKS OF COKE AND COKING COAL

Coke.—Producers' stocks of oven coke on December 31, 1949, increased 10 percent over the previous year. The increase was due largely to the increase in stocks of "domestic and other coke" at merchant plants, as stocks of metallurgical coke at furnace plants decreased slightly. Normally, furnace plants carry only a few days' supply of coke because of the vertical integration of their operations. Merchant plants more often find it necessary to stock coke, especially the domestic sizes. Storage is held at a minimum because of degradation in size, and rescreening before shipment is necessary. The total quantity of oven coke stocked at producers' plants on December 31, 1949, was equivalent to but 9.6 days' production at the prevailing rate. Producers' stocks of beehive coke, which usually are even smaller than stocks carried by oven-coke plants, increased 61 percent over the previous year and totaled 52,898 tons.

Coal.—Adequate stocks of bituminous coal at oven-coke plants are necessary because of the continuous nature of the carbonizing process. Operators usually try to maintain at least a 30 days' supply to assure full-scale operations in case of disruption in the flow of coal to the

plants. In anticipation of mine shut-downs, coke-plant operators built up their inventories of coal in the first half of the year to an all-time record on May 31, 1949, when nearly 16,000,000 tons, or about 59 days' supply, were carried in reserve. Stocks remained at this level during June but started to decline in July and by December 31, 1949, had dropped to less than 10,000,000 tons, or 38 days' supply.

TABLE 40.—Summary of total stocks of coke on hand at all coke plants in the United States on Jan. 1, 1937 and 1946–50, in net tons

[Exclusive of screenings or breeze]

	1937	1946	1947	1948	1949	1950
Oven-coke plants:						
Furnace	282,744	425,438	445,763	376,097	940,727	838,718
Foundry	8,981	24,509	12,565	12,362	7,003	13,120
Domestic and other	1,408,350	477,052	434,585	631,397	612,851	864,720
Total	1,699,475	926,999	892,913	1,019,856	1,560,581	1,716,558
Beehive-coke plants:						
Furnace	5,622	2,455	30,750	10,181	30,629	51,580
Foundry	8,508	270	1,508	50	964	1,118
Domestic and other	18,461	2,089	3,595	2,150	1,267	200
Total	32,591	4,814	35,853	12,381	32,860	52,898
Total:						
Furnace	287,766	427,893	476,513	386,278	971,356	890,298
Foundry	17,489	24,779	14,073	12,412	7,967	14,238
Domestic and other	1,426,811	479,141	438,180	633,547	614,118	864,920
Grand total	1,732,066	931,813	928,766	1,032,237	1,593,441	1,769,456

TABLE 41.—Stocks of coke and breeze in the United States on January 1, 1950, by States, in net tons

State	Coke				Breeze
	Furnace	Foundry	Domestic and other	Total	
Oven coke:					
Alabama	95,670	3,578	21,382	120,630	21,809
California	10,392			10,392	36,247
Colorado	5,648			5,648	3,743
Illinois	46,104	260	8,555	54,919	172,715
Indiana	34,007	1,329	10,321	45,657	198,886
Maryland	58,330			58,330	265,457
Massachusetts		258	120,854	121,112	[illegible]
Michigan	27,867	813	13,963	42,643	17,043
Minnesota	65,757		32,649	98,406	32,357
New Jersey			111,251	111,251	18,600
New York	60,809	48	133,845	194,702	46,416
Ohio	157,787	3,307	7,815	168,129	137,257
Pennsylvania	235,160	411	91,853	327,424	320,967
Tennessee	1,742			1,742	3,466
Texas	2,702	2,743	6,096	11,541	267
Utah	15,333		26,731	42,064	28,780
West Virginia	20,885		24,055	44,940	25,575
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	796	373	154,840	156,009	18,760
Total	838,718	13,120	864,720	1,716,558	1,433,359
At merchant plants	6,941	9,180	708,894	725,015	142,348
At furnace plants	831,777	3,940	155,826	991,543	1,290,941
Beehive coke:					
Pennsylvania	51,002	770		51,772	4,571
Utah	248			248	2,798
Virginia	330	100	200	630	28
West Virginia		230		230	
Total	51,580	1,118	200	52,898	7,397

TABLE 42.—Stocks of oven coke at furnace and merchant plants in the United States at end of each month, 1948–49, in net tons

[Includes furnace, foundry, and domestic coke, but not breeze]

Month	Furnace plants		Merchant plants		Total	
	1948	1949	1948	1949	1948	1949
January	553, 944	1, 112, 854	357, 915	428, 263	911, 859	1, 541, 117
February	617, 770	1, 121, 862	189, 708	382, 276	807, 478	1, 504, 158
March	587, 060	951, 999	128, 467	360, 976	715, 527	1, 312, 975
April	533, 247	1, 015, 200	113, 034	458, 337	646, 281	1, 473, 537
May	644, 315	1, 181, 898	157, 585	565, 779	801, 900	1, 747, 677
June	641, 128	1, 076, 677	214, 507	628, 559	855, 635	1, 705, 236
July	652, 288	1, 076, 861	287, 389	829, 556	939, 677	1, 906, 417
August	716, 446	1, 054, 108	406, 609	972, 704	1, 123, 055	2, 026, 812
September	818, 759	973, 212	468, 125	952, 499	1, 286, 884	1, 925, 711
October	985, 707	1, 226, 852	488, 598	892, 996	1, 474, 305	2, 119, 848
November	1, 058, 954	1, 200, 460	529, 930	816, 841	1, 588, 884	2, 017, 301
December	1, 072, 578	991, 533	488, 003	725, 025	1, 560, 581	1, 716, 558

TABLE 43.—Stocks of bituminous coal at oven-coke plants in the United States at end of each month, 1937 and 1947–49, in net tons

Month	1937	1947	1948	1949
January	8, 030, 871	5, 919, 455	8, 670, 875	12, 480, 691
February	8, 687, 389	6, 644, 699	8, 807, 168	13, 758, 864
March	9, 638, 317	7, 516, 564	7, 434, 582	11, 461, 673
April	8, 543, 774	5, 417, 111	4, 307, 878	12, 913, 613
May	8, 187, 883	6, 454, 434	7, 773, 429	15, 870, 342
June	7, 770, 256	7, 095, 832	10, 474, 191	15, 746, 565
July	7, 432, 741	4, 803, 819	8, 974, 663	13, 895, 773
August	7, 455, 932	5, 483, 859	10, 289, 146	13, 610, 849
September	7, 760, 533	6, 216, 127	10, 967, 839	11, 774, 213
October	8, 066, 938	7, 308, 981	11, 347, 876	9, 946, 069
November	8, 114, 094	8, 206, 627	11, 463, 542	10, 059, 834
December	7, 272, 493	9, 147, 808	12, 104, 428	9, 892, 891

VALUE AND PRICE

The term "value," as used in this report, represents the value of the coke at the ovens as reported by producers. For that part of the output sold, the value is the amount received for the coke f. o. b. ovens. However, the greater part of the coke produced in the United States is made in ovens operated by corporations which not only mine the coal used in the manufacture of coke but also operate blast furnaces and steel mills consuming the entire output of their ovens. Under such conditions, fixing a value for coal charged and for coke produced is governed by established accounting procedures. For example, at some plants the cost of coke to the furnace department equals the cost of production; at others, a margin of profit is added; or the reported value is based on what the coke would cost if purchased. The line between sales and interdepartmental transfers is difficult to draw among such affiliated interests, as a large part of the furnace coke reported as sold actually goes to iron furnaces that are in some way connected with the coke producers. The average value of all coke produced, measured in this way, was $13.24 per ton, the highest figure ever recorded and a gain of 7 percent over 1948 (table 44).

The average price received for each ton of coke sold f. o. b. ovens (merchant sales) in 1949 established a new record and was 4 percent over the 1948 figure. Table 45 shows average receipts from sales classified by uses and by States. It will be noted that prices vary notably with the distances from the mines. Thus, the highest average prices are those reported for the New England and Lake Dock States, where the coal must be hauled great distances.

TABLE 44.—Average value per net ton of coke produced and average receipts per net ton from coke sold (merchant sales) in the United States, 1937 and 1945–49

Year	Value per ton produced			Receipts per ton sold [1]		
	Oven coke	Beehive coke	Total	Oven coke	Beehive coke	Total
1937	$5.03	$4.31	$4.98	$6.45	$4.25	$6.10
1945	7.57	7.36	7.56	8.97	7.51	8.69
1946	8.35	8.03	8.32	10.25	8.35	9.85
1947	10.65	9.77	10.57	11.98	10.31	11.54
1948	12.43	12.10	12.40	14.74	12.80	14.22
1949	13.26	12.87	13.24	15.12	13.52	14.85

[1] Revised figures. Recalculated on basis of merchant sales only which exclude sales to financially affiliated companies.

TABLE 45.—Average receipts per net ton of coke sold (merchant sales) in the United States in 1949, by States

State	Oven coke				Beehive coke			
	Furnace	Foundry	Other industrial including water gas	Domestic	Furnace	Foundry	Other industrial including water gas	Domestic
Alabama	$15.60	$17.68	$15.62	$10.24				
California, Colorado, Texas, and Utah	13.36	18.64	14.13	6.71	(1)	(1)	(1)	
Connecticut, Massachusetts, and Rhode Island		20.48	15.25	15.32				
Illinois	16.20	19.97	13.53	12.67				
Indiana	17.85	(1)	(1)	10.97				
Kentucky, Missouri, and Tennessee	10.56	20.34	14.54	13.53	(1)		(1)	
Michigan, Minnesota, and Wisconsin	14.39	20.70	12.54	13.91				
New Jersey and New York	15.65	(1)	(1)	14.19				
Ohio	12.97	18.38	12.04	11.65				
Pennsylvania	14.04	20.40	14.65	11.67	$12.14	$14.94	$13.14	$11.66
Virginia					14.61	(1)	14.28	(1)
West Virginia	15.50	17.76	9.82	7.20	12.61	(1)	14.40	(1)
Undistributed		20.22	14.70		14.12	16.67	14.47	13.94
United States average 1949	14.60	19.72	13.74	12.50	12.29	15.26	13.71	11.80
At merchant plants	14.57	19.82	14.19	14.28				
At furnace plants	12.95	19.14	11.67	10.10				
United States average 1948	13.78	18.78	13.45	13.17	12.39	15.06	13.35	11.88

[1] Included with "Undistributed."

FOREIGN TRADE [2]

Imports.—Statistics on United States imports include both coal coke and petroleum coke, although the two varieties are segregated in export statistics. Imports of coke in 1949 increased 72 percent over 1948; but the total quantity involved was small in comparison with the national output, and its use was restricted generally in the areas near the points of entry. All of the coke imported in 1949 came from Canada, the bulk of which entered through the Buffalo, Michigan, and Montana-Idaho customs districts. The coke entering through the Montana-Idaho customs district was probably used for smelting nonferrous metals, while that coming in by way of Buffalo and Michigan was used principally for residential heating. Undoubtedly, some of the coke that entered through the Buffalo gateway was petroleum coke and was used for the manufacture of carbon electrodes.

TABLE 46.—Coke imported for consumption in the United States, 1947–49, by countries [1] and customs districts

[U. S. Department of Commerce]

Customs district	1947		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value
Buffalo	129	$2,300	38,399	$648,606	83,053	$1,338,461
Chicago			37	621	7,201	17,421
Connecticut					180	3,058
Dakota			1,682	28,577	1,482	8,885
Hawaii	33	368				
Maine and New Hampshire	314	4,026	350	4,707	346	4,946
Michigan	15,948	121,385	39,597	649,510	114,722	1,813,986
Montana and Idaho	61,993	544,695	62,343	696,024	69,157	774,573
Puerto Rico			605	14,212		
St. Lawrence	57	509			458	6,491
Vermont	120	1,371	109	1,157	316	4,689
Washington	35	298	615	7,223	592	3,275
Wisconsin	25,464	87,585	17,664	61,638		
Total	104,093	762,727	161,400	2,110,275	277,507	3,975,785

[1] All from Canada 1947 and 1949; 1948: Canada 160,795 tons ($2,096,063) and Netherlands 605 tons ($14,212).

Exports.—Exports of coke to foreign countries other than Canada are normally small and have little effect on domestic supplies. Shortages of coke within continental United States during and after World War II made it necessary to place Government control on exports of metallurgical coke, the grade in shortest supply. Exports of metallurgical coke in 1949 to Western Hemisphere countries except Canada were limited to quotas. A quota of 15,000 long tons was placed for South American countries in the first quarter of 1949; it was raised to 20,000 tons in the second and 50,000 tons in the third quarter, and quota limitation was removed at the beginning of the last quarter. The demand for metallurgical coke in the United States throughout the year, however, made it impossible to ship the quotas established, and the total quantity of coke exported to all countries, including

[2] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 47.—Coke exported from the United States, 1947–49, by countries and customs districts

[U. S. Department of Commerce]

	1947		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value
COUNTRY						
North America:						
Canada	585,965	$6,701,624	[1] 561,621	[1] $7,711,145	428,535	$6,341,577
Mexico	16,108	216,419	36,786	664,079	88,393	1,118,491
Panama	66	1,856			11	312
West Indies:						
Cuba	21,429	351,903	17,730	347,507	13,850	242,473
Trinidad and Tobago	77	1,749	104	2,502	194	4,567
Other North America	1,304	39,552	1,228	45,929	1,234	36,706
South America:						
Argentina	41,872	875,217	10,146	235,248		
Bolivia	682	19,597	1,188	47,951	1,447	44,692
Brazil	24,435	721,806	9,599	366,117	1,882	78,752
Chile	8,189	214,413	6,424	177,166	5,929	144,107
Peru	2,186	63,540	644	23,633		
Uruguay	3,009	74,302	2,798	117,179		
Venezuela	938	29,469	737	30,212	590	22,274
Other South America	529	13,304	545	21,196	406	17,482
Europe:						
Belgium-Luxembourg	3,745	65,877				
Denmark	32	614	43	834	10	214
France	10,479	85,902			755	33,950
Ireland	7,388	137,540				
Italy	104	1,945				
Norway	55,425	432,802	46,596	589,777	123	3,633
Portugal	37	406				
Sweden	37,316	431,218	7,958	87,404		
Switzerland	6,539	72,919				
Other Europe	404	14,033				
Asia:						
China	752	7,378	33	1,512		
Hong Kong					1,646	77,399
Philippines	2,474	107,587	2,511	117,349	2,658	138,264
Other Asia	62	2,765	89	4,147	562	18,032
Africa:						
Portuguese Guinea and Angola	3,360	48,715				
Other Africa	153	3,156				
Total	835,059	10,737,805	[1] 796,782	[1] 10,500,937	548,256	8,322,925
CUSTOMS DISTRICT						
Buffalo	267,039	2,873,216	271,733	3,161,865	166,035	2,326,467
Chicago	3,490	30,600				
Dakota	18,757	242,159	20,664	330,742	17,813	321,473
Duluth and Superior	6,153	83,782	6,728	114,971	5,617	99,186
El Paso			5,273	132,238	30,938	464,378
Florida	4,348	81,524	1,432	30,036	975	25,463
Laredo	11,850	181,501	29,784	487,159	55,997	928,645
Maryland	131,133	1,561,491	63,728	944,638	3,187	149,944
Michigan	239,253	3,063,378	[1] 211,418	[1] 3,457,306	223,456	3,371,267
Mobile	2,002	30,644	45	1,053	2,346	65,878
Montana and Idaho			14,519	96,806	81	1,451
New Orleans	36,043	903,951	21,696	686,671	8,181	296,520
New York	5,002	177,918	1,179	32,150	6,290	106,583
Ohio	4,223	77,009	7,692	117,046	11,701	163,411
Philadelphia	10,455	196,796	793	16,797	338	7,509
Rhode Island			2,071	33,800	7,686	119,076
Sabine	26,258	490,522	9,249	179,915		
St. Lawrence	13,578	161,008	4,250	69,444	1,876	14,506
San Diego	512	8,438	965	20,478	717	13,416
San Francisco	2,077	86,835	1,872	82,451	1,516	76,506
Vermont	9,286	101,952	12,984	148,938		
Virginia	15,555	284,506	6,491	198,569	1,081	36,815
Washington	1,897	32,820	9,948	174,607	1,902	42,245
Other districts	5,230	42,865	1,298	35,308	894	12,088
Total	835,059	10,737,805	[1] 796,782	[1] 10,500,937	548,256	8,322,925

[1] Revised figures.

Canada, declined 22 percent from 1948. Canada received 78 percent of the coke exported, most of which moved through the Michigan and Buffalo customs districts. Exports to Mexico more than doubled and represented 16 percent of the total.

TECHNOLOGY

Research and scientific work on coal carbonization in 1949 was high-lighted by the survey being conducted by the Bureau of Mines on coking-coal reserves. The Bureau of Mines program on the appraisal of coking-coal reserves has three objectives. These are: (1) An inventory of minable coking-coal reserves; (2) the basic washing characteristics of these coals; and (3) their basic coking characteristics. This program was initiated in 1948, and progress made in 1949 was summarized recently.[3] Results of other studies on coal carbonization made by Bureau of Mines engineers were published in 1949.[4]

The Fourteenth Annual Report of Research and technologic work conducted by the Bureau of Mines on coal and coal products from July 1, 1948, to July 1, 1949, was released in June 1950.[5] This report gives a brief résumé of the special studies made by Bureau engineers on the carbonizing properties, plasticity, expansion, and oxidation of coal. For details concerning the individual studies, the report lists the original publication and, in addition, presents results of research that have not been already published.

The Mellon Institute of Industrial Research, in its Thirty-seventh Annual Report, covering the fiscal year ended February 28, 1950, summarized studies made on problems relating to coke-plant technology, coke, and coal chemicals.[6]

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[3] Brown, Ralph L., Bureau of Mines Program of Appraising Minable Reserves of Coking Coal: Am. Gas Assoc., Operating Section, Pamph. PC-50-4, May 1950.

[4] Reynolds, D. A., and Wolfson, D. E., Coal Carbonization; Ammonium Sulfate Yields From Coals of Various Regions of the United States: Bureau of Mines Rept. of Investigations 4526, 1949, 15 pp.

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Toenges, A. L., Dowd, J. J., Turnbull, L. A., Davis, J. D., Smith, H. L., and Johnson, V. H., Reserves Petrographic and Chemical Characteristics and Carbonizing Properties of Coal Occurring South of Dry Fork of Minnesota Creek, Gunnison County, Near Paonia, Colo., and the Geology of the Area: Bureau of Mines Tech. Paper 721, 1949, 47 pp., 17 figs.

Davis, J. D., Reynolds, D. A., Brewer, R. E., Wolfson, D. E., and Ode W. H., Carbonizing Properties of No. 5 Block-Bed Coal From No. 5 Mine, Montcoal, Raleigh County, W. Va., and of Pocahontas No. 6-Bed Coal From Birdseye Mine, Sewell, Fayette County, W. Va.: Bureau of Mines Tech. Paper 711, 1949, 72 pp.

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[5] Fieldner, A. C., and Gottlieb, Sidney, Annual Report of Research and Technologic Work on Coal, Fiscal Year 1949: Bureau of Mines Inf. Circ. 7565, 1950, 97 pp.

[6] Chemical and Engineering News, Research and Results at Mellon Institute: Vol. 28, No. 28, May 29, 1950, pp. 1810–1815.

The United International Research, Inc., of Newark, N. J., announced a new low-cost process for producing cresol synthetically from toluene, using a boron catalyst. In this process toluene vapors are bubbled continuously into a reaction vessel containing a boron catalyst dissolved in sulfuric acid. The co-called toluene-boron complex is hydrolyzed with steam or boiling water to yield a mixture of about 80 perc para-, 10 percent meta-, and 10 percent ortho-cresol. Final separatio of cresol from the hydrolysis mixture is aided by stirring in some toluene. After washing, the toluene and cresol are separated by fractionation, and water-white cresol, above USP standards, is obtained as a product. Yield is 80 to 90 percent of cresol, with a residue of cresol resorcinal that may have pharmaceutical uses.[7] A comprehensive review of significant technical developments throughout the world in the field of coal carbonization was published recently.[8] This review summarized studies on raw materials, products and by-products of coal carbonization, oven- and retort-equipment improvements, and procedures for analysis and testing.

WORLD PRODUCTION

Coke is a basic industrial fuel, and production therefore is concentrated largely in the highly industrialized nations. Estimated world production in 1949 was 2 percent higher than in 1948; but it was 23,828,000 tons, or 13 percent, below the record wartime output in 1943. The rise in production of coke in 1949 in many countries that suffered severe war damage indicated that progress was being made in industrial production. The United States has dominated the world in coke production since 1938 and supplied 35 percent of the world total in 1949. Little authentic information has been available on production in the Soviet Union since 1937, but estimates for 1949 place this country next to the United States. Germany assumed temporary world leadership in coke production in 1938; but war damages to coke plants and territorial changes have reduced the output of German coke greatly, and in 1949 the quantity produced in western Germany represented 14 percent of the total. Other important coke-producing countries in 1949 were Great Britain, France (including the Saar), Czechoslovakia, and Poland, which combined furnished 23 percent of the total. The accompanying table contains information on world production so far as data are available.

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[7] Chemical Industries, Boron to Cresol: Vol. 64, No. 3, March 1949, p. 384.
[8] Prien, Chas. H., Pyrolysis of Coal and Shale: Ind. Eng. Chem., vol. 41, No. 9, 1949, pp. 1906–1914.

TABLE 48.—World production of coke by countries, 1938 and 1941–49, in metric tons [1] [2]

[Compiled by Pauline Roberts]

Country	1938	1941	1942	1943	1944	1945	1946	1947	1948	1949
Australia:										
New South Wales	1,153,670	1,738,864	1,644,897	1,592,325	1,402,310	1,061,822	1,069,192	1,323,044	(3)	(3)
Queensland	31,481	30,991	22,529	15,304	14,637	15,903	13,757	18,261	(3)	(3)
Austria	(3)	(3)	(3)	(3)	618,949	69,600	138,000	319,609	591,100	775,900
Belgium	4,398,520	3,662,400	3,588,190	3,497,450	1,456,240	1,346,610	2,399,778	3,065,705	3,733,858	3,472,284
Brazil	---	21,068	10,267	19,845	[4] 16,000	[4] 20,000	133,542	182,674	265,753	(3)
Bulgaria	3,923	4,758	(3)	(3)	(3)	(3)	(3)	(3)	[4] 8,600	(3)
Canada	1,808,588	2,431,942	2,536,165	2,709,354	3,118,481	3,023,248	2,592,357	2,697,070	3,116,221	3,041,315
China	[5] 11,630	[6] 318,445	[6] 388,734	[6] 379,822	[6] 302,466	44,000	95,910	169,000	[4] 92,600	(3)
Formosa	(3)	(3)	(3)	(3)	(3)	45,190	19,308	27,898	31,841	35,971
Czechoslovakia	2,766,000	3,696,000	3,889,000	4,280,000	4,528,000	1,900,557	2,249,859	3,845,000	5,224,000	6,589,000
France	7,636,150	4,892,860	5,008,360	4,989,580	2,908,655	2,730,485	5,150,774	6,002,603	6,099,000	6,769,000
Saar	3,107,000	3,264,830	3,241,439	[7] 3,534,000	(3)	(3)	276,484	1,187,387	2,740,000	3,327,000
French Indochina	3,503	---	4,357	5,293	2,064	---	---	---	---	---
Germany:										
Federal Republic	40,404,082	[8] 47,636,121	[8] 47,996,026	[8] 47,804,000	[8] 41,596,000	[9] 5,284,000	10,404,000	16,154,000	[9] 18,079,000	[9] 23,543,000
Soviet zone						(3)			(3)	(3)
India	1,738,178	2,280,507	2,129,182	1,815,534	1,656,578	1,660,231	1,701,881	(3)	1,665,797	(3)
Italy	1,739,417	1,833,388	1,668,188	1,531,820	498,225	39,203	416,900	960,696	[4] 1,300,000	1,355,600
Japan	[10] 3,724,000	[10] 5,222,000	[10] 5,842,000	6,192,000	4,944,000	2,400,000	924,000	1,164,000	1,932,000	2,580,000
Korea:										
North	377,937	399,860	582,918	851,307	733,216	69,106	(3)	(3)	(3)	(3)
South							2,657	6,644	10,971	4,004
Mexico	(3)	(3)	(3)	(3)	(3)	(3)	(3)	530,400	408,000	374,827
Netherlands	3,158,065	2,256,423	2,048,819	2,163,444	1,575,371	(3)	1,241,000	1,527,520	2,230,500	2,474,400
New Caledonia	49,875	99,700	83,661	(3)	(3)	(3)	(3)	(3)	---	(3)
Norway	(3)	89,092	101,226	110,406	78,558	---	---	---	---	---
Peru	---	(3)	(3)	(3)	(3)	(3)	---	1,641	1,763	(3)
Poland	2,290,925	2,556,382	3,170,076	3,250,344	4,544,211	1,743,239	3,068,019	3,762,787	5,183,300	5,815,700
Rumania	86,030	84,741	86,115	84,212	49,000	37,000	51,000	47,000	(3)	(3)
Southern Rhodesia	47,986	81,016	71,402	78,566	79,857	85,103	85,820	63,689	79,362	(3)
Spain	571,469	753,108	814,355	801,122	862,574	770,714	783,014	815,644	848,375	969,413
Sweden	112,107	(3)	(3)	81,617	32,175	(3)	14,592	[4] 60,000	73,800	82,600
Turkey	85,348	170,696	178,114	182,974	208,623	[11] 182,281	[11] 221,531	323,029	337,471	234,500
Union of South Africa	163,815	226,503	232,498	240,724	176,524	208,147	225,879	238,398	(3)	(3)
U. S. S. R. (estimate)	20,700,000	(3)	[12] 6,085,000	[12] 7,801,000	11,000,000	13,000,000	14,500,000	17,000,000	20,000,000	24,000,000
United Kingdom [13]	13,031,396	14,780,211	15,138,701	14,684,421	14,307,360	14,210,198	14,137,567	14,036,677	15,584,175	15,739,630
United States	29,479,553	59,135,960	64,018,735	65,023,091	67,165,627	61,060,636	53,068,078	66,628,606	67,913,244	57,730,603
Total	139,545,000	173,588,000	182,606,000	187,805,000	169,511,000	112,712,000	115,670,000	144,134,000	160,580,000	163,977,000

[1] Excludes gas-house coke.
[2] Coke is also produced in New Zealand, but data are not available.
[3] Data not available; estimate by senior author of chapter included in total.
[4] Estimate.
[5] Exports.
[6] Areas designated as Free China during the period of Japanese occupation.
[7] Fiscal year ended Mar. 31 of year following that stated.
[8] Includes Silesian production.
[9] British and American zones only.
[10] Preliminary data for fiscal year ended Mar. 31 of year following that stated.
[11] Preliminary figures.
[12] Production of Siberia and Urals only.
[13] In Great Britain production of gas-house coke is especially important: 10,770,130 tons in 1938, averaged 11,000,000 tons per year 1941–45, and increased 15 percent in 1946–47 and 25–30 percent in 1948–49.

COAL-CHEMICAL MATERIALS

GENERAL SUMMARY

The coke industry, in addition to providing American industry with special fuels, furnished chemical raw materials that have been increasing in importance in recent years. Gas, ammonia, crude light oil, and tar are the principal coal-chemical materials, but the term also includes fractions and individual compounds that are recovered therefrom by a chain of chemical processes. Coal chemicals enter many industries and pass from industry to industry as the product of one becomes the raw material for another in the production of a final commodity. For this reason, there exists a definite relationship between the coke industry and countless other industries that depend directly or indirectly on the former as a source of supply of essential chemical raw materials. Although coke-oven gas is a potential source of chemical raw materials, such as hydrogen, ethylene, etc., it is not processed to any appreciable extent in this country, and virtually all of the output is used as fuel for industrial and residential purposes. The increased demand during and since World War II for products made from ammonia, crude light oil, and tar stimulated interest in their manufacture, and coke-plant operators have been constantly developing special technical processes, equipment, and operating technique for their economical production. Evidence of the expansion in refining facilities at coke plants is given by the increased quantities of crude light oil and tar processed in 1949 as compared with 1939. In 1939 about 163,947,000 gallons of crude light oil and 111,783,000 gallons of crude tar were processed by coke-plant operators, whereas in 1949 the figures were, roughly, 220,888,000 and 166,669,000 gallons, increases of 35 and 49 percent, respectively. The increase in raw materials processed has naturally increased the quantities of pure products, such as benzol, toluol, and xylol, produced at coke plants during this period. In spite of the increased production of these products, the revenue obtained from the sale of coal-chemical materials has not kept pace with the increase in coal costs nor with the value credited to coke production. Thus, while average coal costs increased 127 percent in 1949 over 1939, and the average value of coke produced increased 176 percent, the increase in revenue from the sale of all coal-chemical materials per ton of coke amounted to but 11 percent. In other words, the revenue obtained from the sale of coal chemicals was equivalent to 22 percent of the total value of all products compared with 36 percent in 1939.

At the beginning of 1949, supply and demand of most of the basic coal chemicals were in close balance, but as industrial activity began to slacken in the second quarter of the year, requirements were slightly reduced. The change in demand for the chemical grades of benzene (benzol) was one of the outstanding developments during the year. Production of the chemical grades of this commodity was cut back slightly in the latter part of March, and a larger proportion of "motor grade" was recovered. In the ensuing months, the output of "motor benzol" increased substantially at the expense of the chemical grades. However, the strikes in both the bituminous-coal and steel industries during the latter part of the year affected the operation of coke plants and curtailed the output of all coal chemicals. This

development reversed the production pattern of benzol again as demand for the chemical grades increased and coke-plant operators found it necessary to recover as much of these grades as possible. Decreased production of crude naphthalene and creosote oil at coke plants during 1949 may be attributed to (1) a slackening in demand and (2) the substantial quantities of these materials imported from abroad. The increased production of synthetic ammonium sulfate eased the supply situation of this nitrogenous fertilizer material, and sales of coke-oven sulfate lagged considerably behind production. The accompanying tables contain detailed statistics on the production and sales of the various coal-chemical materials in 1949.

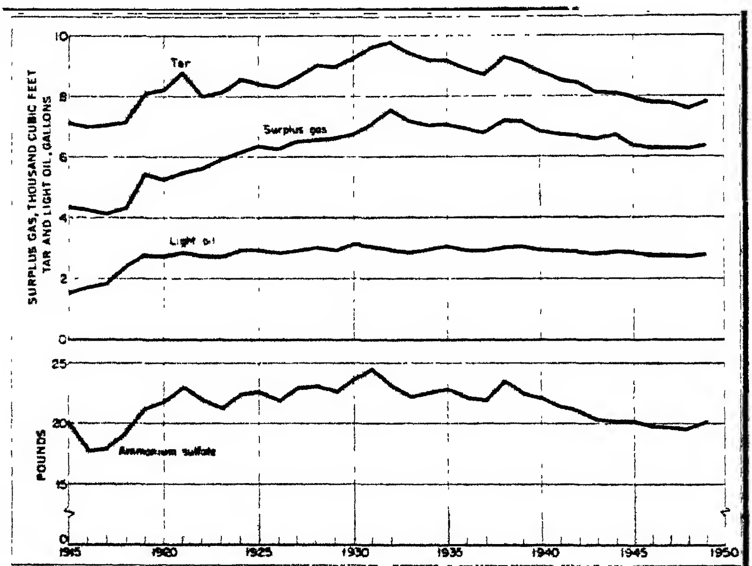

FIGURE 2.—Average yield of principal coal-chemical materials per net ton of coal carbonized in coke ovens, 1915–49. Yields of light oil and ammonium sulfate equivalent represent average for plants recovering these products.

COKE-OVEN GAS

High temperature slot-type coke ovens are primarily producers of specialized forms of fuel. In addition to the main product—coke—another major fuel is recovered in the form of gas. At some plants its importance ranks scarcely second to that of coke itself. In the high-temperature carbonizing process, approximately 10,000 to 12,000 cubic feet, or 17 percent by weight, of the coal carbonized is recovered in the form of fuel gas. Usually, about 37 percent of the total volume of the gas produced is used to heat the ovens, and the remainder (surplus gas) is piped to affiliated metallurgical operations and neighboring industries, and through city mains for public distribution. As a source of revenue to coke-plant operators, it ranks next to coke and since the early 1920's has furnished about 50 percent of the total revenue derived from all coal-chemical materials. The iron and steel industry is the largest consumer of coke-oven gas and in 1949 used

about two-thirds of the surplus gas in metallurgical furnaces or as boiler fuel. Public utilities are the second largest consumer, usually taking about 30 percent of the total. The balance is sold by the producers themselves for industrial purposes, although some of the coke-oven gas going through city mains is used for industrial purposes. Furnace plants produce and distribute by far the larger amount of coke-oven gas; however, merchant plants supply the larger part of the gas distributed through city mains. Public utilities or city gas plants, built primarily to supply gas, received the largest unit value for their product.

CRUDE COAL TAR

Crude-tar production declined 9 percent from 1948, in spite of a slight increase in yield. Tar is used as a fuel, or it may be processed into various useful tar products, depending on business and economic factors. In the early days of the oven-coke industry, virtually all of the tar produced was used as fuel. The Allied blockade during the early stages of World War I shut off our supplies of dyes, intermediates, and other synthetic organic chemicals from abroad and made it necessary for this country to process its tar to make the chemicals formerly imported. The growth of the synthetic organic chemicals industry in the United States has been rapid, and one of the principal raw materials used to make the finished chemical products has been crude coal tar. Plastic, pharmaceutical, paint, dye, and other industries have expanded greatly, absorbing larger and larger quantities of tar, reaching a point in 1946 when only 11 percent of the tar produced was used as fuel. The cost of fuel oil, which can be burned in place of tar, determines whether tar can be sold or processed advantageously, and the quantities burned have varied somewhat in the past several years. Thus, in 1949, 25 percent of the total tar production was burned and 75 percent was processed, either in facilities owned and operated by coke producers or by tar refineries operated independently of coke-oven operations.

Creosote oil, a tar derivative used in the United States mainly for wood preservation, is the principal product made by coke-plant operators and usually supplies about 50 percent of the revenue received from the sale of all tar derivatives. Production of this material declined 30 percent from 1948, largely because of a lower demand and of increased supplies from abroad. The quantity imported (33,395,011 gallons) was nearly one-third greater than the output reported by coke-oven operators. Tar-acid-oil production declined slightly from 1948 but ranked next to creosote oil as a revenue producer, furnishing 36 percent of the total revenue derived from sales of tar derivatives. Details on production and sales of cresols, cresylic acid, anthracene, and other derivatives cannot be disclosed, as less than three producers reported these products to the Bureau of Mines. Virtually all of the pitch output, which decreased 15 percent from 1948, was used by the producers. The soft- and medium-melting-point pitches are cut back (usually with virgin tar) to the desired viscosity and used as metallurgical fuel. The hard pitch produced at several plants is pulverized and mixed with the coal before charging into ovens to improve coke quality.

COKE-OVEN AMMONIA

Total production of coke-oven ammonia (NH_3 equivalent of all forms) in 1949 decreased 9 percent from 1948. Ammonia is recovered at coke plants either as its water solution (ammonia liquor) or as a crystallized ammonium sulfate. In 1949, 80 of the 86 active plants recovered ammonia, 64 of which made ammonium sulfate and 18 ammonia liquor (2 plants produced both sulfate and liquor). Purchased synthetic anhydrous ammonia was converted into sulfate at 5 coke plants in 1949. This practice was adopted by coke-oven operators in the middle of 1947 to alleviate the shortages of nitrogenous fertilizers that have existed since the end of the war. Figures on synthetic sulfate have been tabulated separately by the Bureau to maintain the series on coke-oven sulfate proper. In 1949, however, the production of synthetic ammonium sulfate increased tremendously because of the construction of several huge plants by primary producers of synthetic ammonia. The rise in production of synthetic sulfate eased the supply picture considerably; and coke-oven sulfate shipments dropped below production, so that stocks at the end of the year were nearly three times as large as they were at the beginning. Although prices did not change during the year, indications in the first quarter of 1950 pointed to a decrease in prices from the high level that has prevailed since the end of the war.

CRUDE LIGHT OIL AND DERIVATIVES

Slot-type coke ovens are the principal source of crude light oil from which benzene and its homologs—toluene, xylene, etc.—are recovered. The potential yield of crude light oil per ton of coal varies widely from plant to plant, depending on the quality of coal charged, design and condition of ovens, oven temperatures, and kind of scrubbing equipment. In 1949, the yield of crude light oil ranged from 1.50 to 4 gallons per ton and averaged 2.77 compared with 2.73 in 1948. Most of the light oil produced at coke plants is processed by the producers, and only 3 percent of the output was shipped to independent refiners. Total output in 1949 decreased 11 percent from 1948 to 228,754,333 gallons. Production of benzol (all grades), the principal constituent of light oil, decreased 10 percent from 1948. About 85 percent of the benzol produced was refined into the 1° and 2° grades, although it is known that some of the benzol classed as motor was not actually used as fuel but was sold to tar refineries for processing into chemical grades. The development of new applications for benzol derivatives in synthetic rubber, nylon, insecticides, detergents, and other uses has increased the requirements for industrial benzol far above the quantities used before World War II. As the uses of the new products are exploited, requirements for industrial benzol will undoubtedly increase substantially over the current level and even reach beyond the ability of the coke industry to satisfy with its existing capacity. The expanding markets for pure benzol has stimulated interest in its manufacture from petroleum and production on a commercial scale was reported in 1949.[9]

[9] Chem. Eng. News, vol. 28, No. 16, Apr. 17, 1950, p. 1334.

TABLE 49.—Coal-chemical materials obtained from coke-oven operations in the United States in 1949 [1]

[Exclusive of screenings or breeze]

Product	Production	Sales			On hand Dec. 31
		Quantity	Value		
			Total	Average	
Tar .... gallons..	672,407,370	366,424,711	$31,314,137	$0.085	29,570,187
Tar derivatives:					
Creosote oil, distillate as such ...... do.....	16,971,247	16,811,860	3,168,278	.188	388,399
Creosote oil, in coal-tar solution do.....	7,407,357	6,700,909	1,043,297	.156	301,392
Tar acid oil .... do.....	12,246,503	11,885,317	3,540,247	.298	801,381
Phenol .... pounds..	6,311,948	6,327,442	700,233	.111	203,980
Pitch-of-tar:					
Soft [2] .... net tons..	304,882	8,433	231,310	27.429	12,426
Hard [3] .... do.....	234,919	5,335	96,205	18.033	531
Other tar derivatives [4]			1,022,696		
Ammonia:					
Sulfate:					
From coke-oven ammonia ... pounds..	1,513,613,773	1,421,187,308	31,990,441	.023	138,777,619
From purchased synthetic ammonia .... pounds..	117,652,021	118,103,344	2,951,960	.025	628,622
Liquor (NH_3 content) .... do.....	45,499,541	40,582,835	1,600,103	.039	1,707,984
			[5] 33,590,544		
Sulfate equivalent of all forms [6] .. do.....	1,695,611,937	1,583,518,648			145,609,555
NH_3 equivalent of all forms [6] .... do.....	423,902,984	395,879,662			36,402,389
Gas:					
Used under boilers, etc. M cubic feet..	[7] 882,309,827	27,459,095	3,946,741	.144	
Used in steel or allied plants ...... do.....		329,560,954	55,220,339	.168	
Distributed through city mains .. do.....		154,994,365	57,087,966	.368	
Sold for industrial use .... do.....		34,134,554	5,123,786	.150	
	[7] 882,309,827	546,148,968	121,378,832	.222	
Crude light oil .... gallons..	[8] 228,754,333	14,566,187	1,611,058	.111	3,826,701
Light-oil derivatives:					
Benzol:					
Motor .... do.....	20,923,704	20,949,753	2,832,688	.135	592,540
All other grades .... do.....	122,741,464	122,796,219	24,368,000	.198	2,879,807
Toluol, crude and refined .... do.....	27,670,579	27,509,355	5,808,080	.211	980,054
Xylol, crude and refined .... do.....	7,264,642	7,181,441	1,817,562	.253	478,607
Solvent naphtha .... do.....	4,997,082	4,796,522	877,362	.183	380,953
Other light oil products [9] .... do.....	7,122,732	4,803,460	547,875	.114	296,640
	190,720,303	188,036,750	36,251,767	.193	6,548,631
Naphthalene, crude .... pounds..	70,823,436	59,907,600	2,654,815	.044	12,978,279
Pyridine:					
Crude bases (dry basis) .... gallons..	305,854	400,655	458,322	1.146	57,882
Refined or 2° C .... pounds..	1,044,642	1,004,125	742,490	.739	[illegible]
Sodium phenolate .... gallons..	2,137,813	2,062,129	353,794	.172	[illegible]
Sulfur .... pounds..	8,226,949	8,415,925	120,221	.014	1,418,000
Other coal-chemical materials [10]			441,452		
Value of all coal-chemical materials sold			256,720,731		

[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name.
[2] Softening point less than 110° F. Includes some medium pitch-of-tar reported by 2 producers.
[3] Softening point over 160° F.
[4] Cresols, cresylic acid, fuel oil, pitch coke, refined tar, and tar paint.
[5] Excludes value of sulfate made from purchased synthetic ammonia.
[6] Excludes sulfate made from purchased synthetic ammonia.
[7] Includes gas used for heating ovens and gas wasted.
[8] 220,868,075 gallons refined on premises to make derived products shown.
[9] Benzol still residue, dicyclopentadiene, orthoxylene, and vented vapors.
[10] Ammonium thiocyanate, picolines, secondary oil, and sodium prussiate.

Toluol production declined slightly from the 1948 output but was about 50 percent higher than the average annual prewar output in 1935–39. Unlike benzol, which at the present is virtually all recovered from coal carbonization, large quantities of toluol are made from petroleum. Toluol is used extensively as a solvent, particularly in the field of synthetic plastics, and it is also used for synthesizing a number of other chemicals, such as benzoic acid. In wartime its importance is derived from its use in the manufacture of explosives and also for enriching aviation gasoline. Prices of toluol did not change materially from 1948, although they were considerably less than the wartime average. Production and prices of xylol and solvent naphtha showed only minor changes when compared with 1948.

TABLE 50.—Coal equivalent of coal-chemical materials produced at oven-coke plants in the United States, 1913, 1914, 1918, 1937, and 1947–49

Year	Quantity of coal-chemical materials				Estimated equivalent in heating value (billion B. t. u.)					Coal equivalent	
	Coke breeze (thousand net tons)	Surplus gas (billion cubic feet)	Tar produced (thousand gallons)	Light oil produced (thousand gallons)	Coke breeze	Surplus gas	Tar	Light oil	Total	Net tons	Percent this forms of coal made into coke
1913	735	64	115,145	3,000	14,700	35,200	17,272	390	67,562	2,600,000	3.8
1914	667	61	109,901	8,464	13,340	33,550	16,485	1,100	64,475	2,461,000	4.8
1918	1,999	156	203,299	87,562	39,980	86,900	30,495	11,383	177,758	6,785,000	8.0
1937	3,884	463	603,053	187,054	77,680	254,650	90,458	24,317	447,105	17,065,000	22.9
1947	5,474	593	736,174	254,978	109,480	326,150	110,426	33,147	579,203	22,107,000	21.0
1948	5,766	608	738,755	256,089	115,320	334,400	110,813	33,292	593,825	22,665,000	21.1
1949	4,929	546	672,407	228,754	98,582	300,300	100,861	29,738	529,481	20,209,000	22.1

TABLE 51.—Value of coal-chemical materials and of coke, including breeze, per ton of coke produced in the United States, 1937 and 1946–49

Product	1937	1946	1947	1948	1949
Ammonia and its compounds	$0.326	$0.361	$0.423	$0.545	$0.558
Light oil and its derivatives (including naphthalene)	.435	.467	.566	.685	.673
Surplus gas sold or used	1.483	1.542	1.678	1.839	2.015
Tar sold	.375	.395	.464	.614	.520
Miscellaneous products	.066	.154	.196	.229	.198
	2.685	2.919	3.327	3.912	3.964
Tar used, not sold	.127	.071	.141	.214	.202
Breeze produced	.162	.217	.242	.293	.281
	2.974	3.207	3.710	4.419	4.447
Value of coke produced	5.026	8.345	10.652	12.429	13.264
Total value of coke and coal-chemical materials	8.000	11.552	14.362	16.848	17.711

TABLE 52.—Coke-oven gas produced and sold in the United States in 1949, by States, in thousands of cubic feet

State	Active plants	Produced	Used in heating ovens	Surplus sold or used			Wasted
				Quantity	Value		
					Total	Average	
Alabama	7	74,427,363	33,596,886	39,364,213	$4,363,678	$0.111	1,466,264
California	1	6,442,551	307,202	6,079,994	(1)	(1)	55,355
Colorado	1	12,674,545	6,344,341	6,114,104	(1)	(1)	216,100
Illinois	8	44,614,351	14,715,723	29,080,923	4,575,340	.157	817,705
Indiana	5	99,654,041	45,210,648	53,337,405	12,956,384	.243	1,105,988
Maryland	1	29,437,739	8,932,530	19,589,209	(1)	(1)	916,000
Massachusetts	2	13,840,134	2,368,483	11,464,519	(1)	(1)	7,132
Michigan	4	37,731,318	5,812,351	31,860,834	5,752,812	.181	58,133
Minnesota	3	11,006,317	4,877,247	5,991,587	1,462,448	.244	137,483
New Jersey	2	20,380,714	5,486,576	14,894,138	(1)	(1)	----------
New York	8	79,131,887	20,525,328	57,841,394	20,478,213	.354	765,165
Ohio	15	126,940,529	55,950,361	68,889,655	11,646,307	.169	2,100,513
Pennsylvania	13	218,281,656	92,032,537	124,908,846	24,708,522	.198	1,340,273
Tennessee	1	3,039,543	1,299,459	1,703,347	(1)	(1)	36,737
Texas	2	7,572,525	2,705,043	3,427,187	(1)	(1)	1,440,295
Utah	2	17,046,668	4,632,108	11,898,855	(1)	(1)	515,705
West Virginia	5	49,602,513	14,211,035	34,793,232	5,488,104	.158	598,246
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6	30,485,433	5,424,557	24,909,526	8,630,849	.346	151,350
Undistributed	------	----------	----------	----------	21,316,175	.284	----------
Total 1949	86	882,309,827	324,432,415	546,148,968	121,378,832	.222	11,728,444
At merchant plants	31	176,605,463	40,324,945	135,430,449	50,600,952	.374	850,069
At furnace plants	55	705,704,364	284,107,470	410,718,519	70,777,880	.172	10,878,375
Total 1948	86	994,852,626	370,655,816	607,810,835	125,555,996	.207	16,385,975

[1] Included with "Undistributed."

TABLE 53.—Coke-oven gas and other kinds of gas used in heating ovens in 1949, by States, in thousands of cubic feet [1]

State	Coke-oven gas	Producer gas	Blue-water gas	Blast-furnace gas	Other gases [2]	Total coke-oven gas equivalent
Alabama	33,596,886	----------	----------	----------	472,899	34,069,785
California	307,202	----------	----------	2,409,661	----------	2,716,863
Colorado	6,344,341	----------	----------	----------	----------	6,344,341
Illinois	14,715,723	----------	----------	3,688,766	2,727,848	21,132,337
Indiana	45,210,648	1,125,137	409,039	----------	29,755	46,774,579
Maryland	8,932,530	----------	----------	3,622,034	----------	12,554,564
Massachusetts	2,368,483	3,821,181	----------	----------	----------	6,189,664
Michigan	5,812,351	----------	----------	8,126,280	----------	13,938,631
Minnesota	4,877,247	----------	183,400	----------	18,239	5,078,886
New Jersey	5,486,578	3,767,306	----------	----------	----------	9,253,884
New York	20,525,328	11,094,093	1,272,899	461,457	110,654	33,464,031
Ohio	55,950,361	----------	----------	1,638,285	169,688	57,748,334
Pennsylvania	92,032,537	1,771,844	----------	2,161,310	1,324,826	97,290,517
Tennessee	1,299,459	----------	----------	----------	----------	1,299,459
Texas	2,705,043	----------	----------	----------	----------	2,705,043
Utah	4,632,108	----------	----------	2,684,852	----------	7,316,960
West Virginia	14,211,035	----------	----------	5,215,042	733,700	20,159,777
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5,424,557	5,730,931	----------	----------	1,419,487	12,583,975
Total	324,432,415	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
At merchant plants	40,324,945	27,031,087	1,882,138	----------	5,632,889	74,671,066
At furnace plants	284,107,470	288,407	183,400	20,995,887	1,373,598	315,948,571

[1] Adjusted to an equivalent of 550 B. t. u. per cubic foot.
[2] Butane-air, natural, oil, propane-air, and spillage gases.

TABLE 54.—Disposal of surplus coke-oven gas in the United States in 1949, by States, in thousands of cubic feet

State	Used by producer—						Sold					
	Under boilers			In steel or allied plants			Distributed through city mains			For industrial purposes		
	Quantity	Value		Quantity	Value		Quantity	Value		Quantity	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
Alabama	8,475,400	$939,753	$0.111	23,061,550	$2,625,786	$0.114	6,524,845	$672,646	$0.103	1,302,418	$125,493	$0.096
California	33,753	(1)	(1)	6,046,241	(1)	(1)						
Colorado				5,114,104	(1)	(1)						
Illinois	4,252,005	515,574	.121	6,818,120	(1)	(1)	17,590,123	2,703,372	.154	420,675	(1)	(1)
Indiana	2,856,615	(1)	(1)	46,482,409	7,341,947	.182	7,739,614	4,336,691	.560	2,308,767	(1)	(1)
Maryland				11,697,397	(1)	(1)	7,891,812	(1)	(1)			
Massachusetts	3,920	(1)	(1)				11,408,420	(1)	(1)	52,179	(1)	(1)
Michigan	2,016,948	(1)	(1)	27,397,856	4,873,857	.178				2,440,030	(1)	(1)
Minnesota	126,117	16,182	.128	2,132,750	(1)	(1)	2,197,600	(1)	(1)	1,535,120	(1)	(1)
New Jersey				432	(1)	(1)	14,893,706	(1)	(1)			
New York	1,033,742	(1)	(1)	17,240,462	(1)	(1)	38,591,974	16,657,366	.432	975,216	275,047	.282
Ohio	4,166,544	691,334	.166	50,637,373	8,567,918	.169	3,543,368	955,242	.270	10,542,370	1,431,813	.136
Pennsylvania	2,480,726	380,908	.154	98,320,764	15,340,227	.164	23,382,752	8,288,908	.354	5,724,605	698,410	.122
Tennessee	246,553	(1)	(1)				1,456,794	(1)	(1)			
Texas				5,427,187	(1)	(1)						
Utah	19,024	(1)	(1)	11,619,572	(1)	(1)				260,259	(1)	(1)
West Virginia	843,247	(1)	(1)	29,614,737	4,795,131	.162				4,335,248	(1)	(1)
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	904,502	148,214	.164				19,773,357	7,994,912	.404	4,231,667	487,723	.115
Undistributed		1,264,716	.178		11,675,473	.179		15,478,829	.409		2,105,291	.185
Total, 1949	27,459,095	3,946,741	.144	329,560,954	55,220,339	.168	154,994,365	57,087,966	.368	34,134,554	5,123,786	.150
At merchant plants	4,539,621	496,898	.109	6,136,563	1,332,335	.217	103,589,317	45,530,189	.440	21,164,948	3,241,530	.153
At furnace plants	22,919,474	3,449,843	.151	323,424,391	53,888,004	.167	51,405,048	11,557,777	.225	12,969,606	1,882,256	.145
Total, 1948	33,152,844	4,086,099	.123	369,457,173	57,728,546	.156	169,347,914	58,229,890	.344	35,852,904	5,511,461	.154

1 Included with "Undistributed."

TABLE 55.—Coke-oven tar produced, used by producer, and sold in the United States in 1949, by States, in gallons

State	Produced		Used by producer—				Sold—					On hand Dec. 31
	Total	Per ton of coal coked	For refining or topping	As fuel under boilers	In open hearth or allied plants	Otherwise	For use as fuel [1]	For refining into tar products	Total			
									Quantity	Value		
										Total	Average	
Alabama	57,302,383	7.87	1,569,567	1,292,377	23,095,008	169,576		32,164,963	32,164,963	$2,863,351	$0.089	1,914,024
California	5,762,938	9.95	5,947,809									157,370
Colorado	10,270,069	9.88	9,121,168		1,178,087	5,540		11,086	11,086	(2)	(2)	116,195
Illinois	30,720,808	6.69	2,465,300	243,769		120,035	527,710	27,898,283	28,425,993	2,487,948	.088	1,018,321
Indiana	59,160,360	5.67	6,014,965	830,179	14,530,176	1,182,718		37,362,257	37,362,257	3,306,929	.089	2,606,283
Maryland	21,268,005	7.49			4,054,134			17,672,581	17,672,581	(2)	(2)	2,179,223
Massachusetts	9,360,788	7.40					205,075	10,065,628	10,270,703	(2)	(2)	404,427
Michigan	24,712,016	7.10		299,954		750		25,199,651	25,199,651	2,098,696	.083	1,122,186
Minnesota	6,702,604	6.10			2,530,253			4,401,779	4,401,779	(2)	(2)	501,754
New Jersey	14,310,247	7.78						14,375,888	14,375,888	(2)	(2)	368,400
New York	56,910,773	7.97	15,374,060			8,272	3,793,754	39,544,913	43,338,667	3,850,035	.089	3,640,745
Ohio	89,561,758	7.06	1,947,593	542,089	37,725,049	592,302	2,802,915	46,222,806	49,025,721	4,165,617	.085	4,496,979
Pennsylvania	195,182,930	9.02	124,228,499	19,510	48,321,510	199,100	56,402	21,218,372	21,274,774	1,772,204	.083	8,413,532
Tennessee	2,160,881	7.12						2,176,942	2,176,942	(2)	(2)	31,142
Texas	4,766,620	6.72						4,873,484	4,873,484	(2)	(2)	311,953
Utah	15,273,968	10.42			6,183,154			9,093,705	9,093,705	(2)	(2)	636,481
West Virginia	46,179,297	10.22		15,660		60,818	20,134,174	25,837,970	45,972,144	4,017,525	.087	796,240
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	20,791,916	7.37						20,784,373	20,784,373	1,728,320	.083	824,932
Undistributed										5,023,512	.080	
Total 1949	672,407,370	7.81	166,668,961	2,743,538	137,617,471	2,348,109	27,520,030	338,904,681	366,424,711	31,314,137	.085	29,570,187
At merchant plants	132,943,432	7.84	1,569,567	15,660		58,782	205,075	132,209,129	132,414,204	11,273,733	.085	4,759,639
At furnace plants	539,463,938	7.81	165,099,394	2,727,878	137,617,471	2,289,327	27,314,955	206,695,552	234,010,507	20,040,404	.086	24,810,548
Total 1948	738,755,106	7.60	194,234,529	1,439,843	136,281,853	2,341,804	34,677,377	367,730,103	402,407,480	41,957,748	.104	32,828,763

[1] Comprises 27,083,871 gallons sold to affiliated companies and 436,159 gallons sold to other purchasers.
[2] Included with "Undistributed."

TABLE 56.—Coke-oven ammonia produced and sold in the United States in 1949, by States, in pounds

State	Active plants	Produced				Sold as—				On hand Dec. 31	
		Sulfate equivalent	Per ton of coal coked	As sulfate	As liquor (NH_3 content)	Sulfate		Liquor (NH_3 content)		Sulfate	Liquor (NH_3 content)
						Quantity	Value	Quantity	Value		
Alabama	7	170,785,314	23.45	163,740,710	1,761,151	161,467,631	$3,594,571	1,722,461	(1)	7,274,795	57,502
California	1	15,359,724	26.55	15,359,724		14,781,890	(1)			594,634	
Colorado	1	24,601,800	22.46	24,601,800		22,688,795	(1)			4,293,365	
Illinois	6	77,673,628	18.96	77,673,628		75,633,755	1,572,279			3,400,857	
Indiana	5	172,487,954	16.53	150,928,506	5,389,862	126,395,129	2,819,832	4,689,559	$172,401	31,991,750	444,003
Maryland	1	58,822,368	20.71	58,822,368		57,526,260	(1)			2,573,464	
Massachusetts	1	21,569,140	17.35	21,569,140		20,673,680	(1)			1,323,860	
Michigan	4	66,790,043	19.19	23,014,647	10,943,849	19,708,851	(1)	9,054,843	(1)	3,408,953	228,581
Minnesota	3	18,303,576	16.66	18,303,576		15,626,190	354,822			3,369,559	
New Jersey	2	36,300,272	19.75	36,300,272		35,598,060	(1)			2,450,495	
New York	8	148,222,005	20.06	122,767,977	6,363,507	120,592,555	2,755,199	5,867,639	231,731	6,220,526	156,147
Ohio	15	240,297,049	18.94	192,181,613	12,028,859	184,177,675	4,135,418	10,434,065	401,273	16,265,885	415,319
Pennsylvania	13	455,163,319	21.03	453,025,899	534,355	415,409,567	9,339,368	508,575	(1)	46,264,251	50,642
Tennessee	1	6,265,772	20.55	6,265,772		5,839,361	(1)			528,965	
Texas	2	16,028,238	22.60	16,028,238		15,451,060	(1)			777,878	
Utah	2	37,873,728	25.82	37,873,728		35,750,309	(1)			4,130,121	
West Virginia	3	77,257,344	21.97	77,257,344		76,091,065	1,660,494			3,492,065	
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5	51,810,663	19.08	17,898,831	8,477,958	17,775,475	412,835	8,305,693	319,736	407,196	355,790
Undistributed							5,345,623		474,962		
Total 1949	80	1,695,611,937	20.08	1,513,613,773	45,499,541	1,421,187,308	31,990,441	40,582,835	1,600,103	138,777,619	1,707,984
At merchant plants	26	315,106,521	20.00	191,807,057	30,824,866	185,567,165	4,281,092	32,146,926	1,253,548	11,489,903	1,063,894
At furnace plants	54	1,380,505,416	20.10	1,321,806,716	14,674,675	1,235,620,143	27,709,349	8,435,909	346,555	127,287,716	644,090
Total 1948	81	1,859,386,041	19.52	1,661,365,037	49,505,251	1,665,530,716	35,561,991	40,649,246	1,617,277	47,850,209	992,784

1 Included with "Undistributed."

TABLE 57.—Coke-oven crude light oil produced in the United States and derived products obtained and sold in 1949, by States, in gallons

State	Active plants	Produced: Total	Produced: Per ton of coal coked	Refined on premises [1]	Derived products: Produced	Derived products: Sold [2]: Quantity	Derived products: Sold [2]: Value	On hand Dec. 31
Alabama	7	20,357,263	2.80	20,317,842	17,524,322	17,317,097	$3,401,061	332,516
California	1	1,984,029	3.43	1,979,007	1,688,334	1,524,105	(3)	21,109
Colorado	1	3,425,281	3.13	3,411,601	3,090,811	2,877,767	(3)	61,988
Illinois	7	10,991,453	2.43	8,225,634	6,865,963	6,939,697	1,359,717	204,412
Indiana	5	24,047,464	2.30	24,584,679	22,298,378	22,085,882	4,458,501	368,576
Maryland	1	11,132,933	3.92	11,124,026	9,808,669	10,187,101	(3)	154,991
Michigan	4	7,214,115	2.42	5,827,208	5,275,859	4,946,011	1,049,001	248,770
New York	8	19,157,352	2.59	26,876,247	23,552,403	24,016,073	4,594,243	199,238
Ohio	15	35,364,107	2.79	31,263,152	25,278,981	24,825,828	4,612,794	412,390
Pennsylvania	13	64,271,787	2.97	64,342,897	56,045,802	55,218,791	10,685,958	1,296,475
Tennessee	1	823,265	2.70	831,806	752,920	800,116	(3)	------
Texas	2	1,960,900	2.77	1,960,900	1,586,893	1,562,959	(3)	62,605
Utah	2	5,536,959	3.78	5,505,422	4,423,619	4,417,698	(3)	107,630
West Virginia	5	13,668,036	3.02	11,515,647	9,698,320	8,551,014	1,568,019	71,568
Kentucky, Massachusetts, Minnesota, Missouri, New Jersey, and Wisconsin	6	8,819,389	2.19	3,122,007	2,738,909	2,756,611	530,084	284,514
Undistributed	------	------	------	------	------	------	3,992,389	------
Total 1949	78	228,754,333	2.77	220,888,075	190,720,203	188,026,750	36,251,767	3,826,701
At merchant plants	25	32,439,504	2.29	26,750,091	23,966,488	22,831,015	4,214,502	918,812
At furnace plants	53	196,314,829	2.87	194,137,984	166,753,715	165,195,735	32,037,265	2,907,889
Total 1948	79	256,089,065	2.73	242,956,216	208,551,083	204,409,092	40,162,119	3,794,990

[1] Comprises 213,723,170 gallons of crude light oil from own production and 7,164,905 gallons purchased from other coke plants.
[2] Excludes 14,566,187 gallons of crude light oil valued at $1,611,058 sold as such.
[3] Included with "Undistributed."

TABLE 58.—Trend in yields of products obtained from refining crude light oil at oven-coke plants, 1937 and 1941–49, in percent

Year	Benzol: Motor	Benzol: All other grades	Toluol, crude and refined	Xylol, crude and refined	Solvent naphtha	Other light-oil products
1937	52.5	11.9	11.5	2.5	3.1	4.5
1941	47.2	16.8	13.0	3.4	2.3	3.6
1942	26.8	35.3	13.4	2.9	2.2	3.8
1943	8.6	53.9	13.1	3.6	2.1	3.6
1944	7.1	56.6	12.9	3.3	2.1	3.5
1945	12.3	53.9	11.5	3.2	2.0	3.3
1946	13.8	55.3	8.3	3.0	2.2	3.8
1947	6.5	60.1	10.9	3.0	2.3	3.5
1948	3.7	61.7	11.7	3.0	2.4	3.3
1949	9.5	55.6	12.5	3.3	2.3	3.2

TABLE 59.—Production of benzol and toluol, by grades, at oven-coke plants, 1941–49, in gallons

Year	Benzol				Toluol		
	Motor	Nitration or 1° C.	Pure commercial or 2° C.	All other	Nitration or 1° C.	Pure commercial or 2° C.	All other
1941	106,372,000	15,414,500	18,286,400	4,182,600	14,689,800	13,268,500	1,378,900
1942	64,797,600	25,624,400	53,617,900	6,014,700	25,160,200	5,044,800	2,109,600
1943	21,267,900	35,047,800	93,246,600	4,144,800	27,152,300	2,394,700	2,725,600
1944	18,556,600	41,285,800	102,436,500	3,187,600	29,771,100	2,149,600	1,607,500
1945	28,788,100	39,166,500	86,237,300	1,266,700	23,355,400	2,219,700	1,494,200
1946	27,398,900	35,739,300	71,681,700	2,308,000	12,518,000	2,796,400	1,205,400
1947	15,802,700	42,475,300	100,111,800	2,470,800	20,514,100	4,989,500	892,800
1948	9,014,300	43,541,200	103,356,300	3,101,400	22,899,700	5,280,800	267,800
1949	20,923,700	28,988,700	91,717,300	2,035,500	20,808,300	6,317,200	545,100

NAPHTHALENE

TABLE 60.—Crude naphthalene produced and sold by coke-plant operators in the United States, 1937 and 1944–49

Year	Produced (pounds)	Sold			Receipts per ton of coke
		Pounds	Value		
			Total	Average per pound	
1937	60,797,108	60,315,581	$1,182,992	$0.020	$0.024
1944	103,041,023	103,839,789	2,094,596	.020	.031
1945	87,677,299	86,936,517	1,806,967	.021	.029
1946	71,605,138	71,769,750	1,602,739	.022	.030
1947	98,378,875	98,364,997	3,021,152	.031	.045
1948	105,816,670	102,827,490	4,545,867	.044	.067
1949	76,823,436	59,907,690	2,654,815	.044	.044

COKE OVENS OWNED BY CITY GAS COMPANIES (PUBLIC UTILITIES)

The accompanying table compares the activities of coke plants operated by gas utilities with those not owned by city gas companies for 1948 and 1949. This classification is maintained by the Bureau of Mines in the interest of those who may wish to follow coal carbonizing at public utility plants and also to show their relative value to the coke industry as a whole.

Normally, maximum production of gas of proper analysis is the primary objective of these plants; however, the extremely heavy demand for industrial coke during and since the end of World War II has caused many operators to place a greater emphasis on coke, and in 1949 more than a million tons of metallurgical coke from this group were shipped to iron blast furnaces and foundry cupolas. Although the volume of coke production has not decreased markedly in recent years, the number of operators has been declining steadily because of the substitution of natural gas for coke-oven gas in certain areas. In 1949, the Lynn Gas & Electric Co., Lynn, Mass., discontinued operating its oven-coke plant, leaving but 12 city-gas coke plants in operation at the end of the year. Several other companies are planning the

substitution of natural gas for coke-oven gas in 1950 and will be closed down unless the plants can be disposed of to other interests. City gas plants in 1949 contributed 6 percent of the total production of oven coke, gas, and tar, 4 percent of the crude light oil, and 5 percent of the ammonia.

TABLE 61.—Production of coke, breeze, and coal-chemical materials in the United States at oven-coke plants owned by city gas companies (public utilities) [1] and all other oven-coke plants, 1948–49

Product	1948			1949		
	Plants not owned by city gas companies [2]	Plants owned by city gas companies (public utilities) [2]	Total	Plants not owned by city gas companies	Plants owned by city gas companies (public utilities)	Total
Number of active plants	73	13	86	73	13	86
Coke:						
Production..net tons	64,402,384	3,881,973	68,284,357	56,574,488	3,647,993	60,222,481
Value	$791,741,641	$56,977,442	$848,719,083	$742,989,908	$55,802,161	$798,792,069
Average per ton	$12.29	$14.68	$12.43	$13.13	$15.30	$13.20
Screenings or breeze:						
Production..net tons	5,360,330	405,246	5,765,576	4,548,977	380,109	4,929,086
Sales.....do	1,101,298	20,313	1,121,611	1,029,718	25,741	1,055,459
Value of sales	$4,529,056	$83,002	$4,612,058	$4,010,520	$95,494	$4,106,014
Average per ton	$4.11	$4.09	$4.11	$3.89	$3.71	$3.89
Coal charged into ovens:						
Bituminous net tons	91,448,755	5,535,388	96,984,143	80,669,066	5,212,510	85,881,576
Anthracite.....do	209,756	46,419	256,175	141,206	31,619	172,825
Total.....do	91,658,511	5,581,807	97,240,318	80,810,272	5,244,129	86,054,401
Value	$737,067,687	$53,382,920	$790,450,607	$680,734,929	$52,611,679	$733,346,608
Average per ton	$8.04	$9.56	$8.13	$8.42	$10.03	$8.52
Coke—						
Used by producer:						
Net tons	40,362,243	1,450,087	41,812,330	36,211,133	1,376,648	37,587,781
Value	$479,439,505	$17,943,557	$497,383,062	$464,324,758	$18,467,571	$482,792,329
Sold:						
Net tons	23,396,833	2,448,484	25,845,317	20,248,133	2,233,340	22,481,473
Value	$304,219,185	$39,246,127	$343,465,312	$276,648,096	$36,848,968	$313,497,064
Coal-chemical materials:						
Tar:						
Production gallons	692,935,209	45,819,897	738,755,106	629,182,418	43,224,952	672,407,370
Sales.....do	356,828,280	45,579,200	402,407,480	322,473,628	43,961,073	366,434,711
Value of sales	$37,312,076	$4,645,672	$41,957,748	$27,316,496	$3,997,641	$31,314,137
Ammonia:						
Production (NH_3 equivalent of all forms)..pounds	442,666,096	22,180,414	464,846,510	401,245,706	22,657,278	423,902,984
Liquor (NH_3 content):						
Production..pounds	47,389,668	2,115,583	49,505,251	43,185,514	2,314,027	45,499,541
Sales.....do	44,599,274	2,049,072	46,648,346	38,930,265	1,632,570	40,562,835
Value of sales	$1,563,170	$54,107	$1,617,277	$1,548,842	$51,261	$1,600,103
Sulfate:						
Production..pounds	1,581,106,713	80,259,324	1,661,366,037	1,432,240,776	81,372,997	1,513,613,773
Sales.....do	1,583,954,037	81,576,679	1,665,530,716	1,343,240,303	77,947,005	1,421,187,308
Value of sales	$33,838,088	$1,723,903	$35,561,991	$30,214,894	$1,775,547	$31,990,441
Gas:						
Production M cubic ft.	933,865,586	60,987,050	994,852,636	825,080,212	57,228,615	882,308,827

See footnotes at end of table.

TABLE 61.—Production of coke, breeze, and coal-chemical materials in the United States at oven-coke plants owned by city gas companies (public utilities)[1] and all other oven-coke plants, 1948–49—Continued

Product	Plants not owned by city gas companies[2]	Plants owned by city gas companies (public utilities)[2]	Total	1949: Plants not owned by city gas companies	1949: Plants owned by city gas companies (public utilities)	1949: Total
Coal-chemical materials—Con.						
Gas—Continued						
Disposal of surplus:						
Used under boilers, etc.:						
M cubic feet	32,947,179	205,665	33,152,844	27,133,800	325,295	27,459,095
Value	$4,053,120	$32,979	$4,086,099	$3,893,550	$53,191	$3,946,741
Average per M cubic feet	$0.123	$0.160	$0.123	$0.143	$0.164	$0.144
Used in steel or allied plants:						
M cubic feet	369,457,173	------------	369,457,173	329,557,820	3,134	329,560,954
Value	$57,728,546	------------	$57,728,546	$55,218,490	$1,849	$55,220,339
Average per M cubic feet	$0.156	------------	$0.156	$0.168	$0.590	$0.168
Distributed through city mains:						
M cubic feet	115,894,481	53,453,433	169,347,914	103,792,212	51,202,153	154,994,365
Value	$37,014,721	$21,215,169	$58,229,890	$34,467,932	$22,620,034	$57,087,966
Average per M cubic feet	$0.319	$0.397	$0.344	$0.332	$0.442	$0.368
Sold for industrial use:						
M cubic feet	33,761,443	2,091,461	35,852,904	32,406,477	1,728,077	34,134,554
Value	$4,560,742	$950,719	$5,511,461	$4,333,678	$790,108	$5,123,786
Average per M cubic feet	$0.135	$0.455	$0.154	$0.134	$0.457	$0.150
Crude light oil:						
Production gallons	247,872,036	8,217,029	256,089,065	220,705,200	8,049,133	228,754,333
Sales do	14,794,647	2,848,114	17,642,761	10,191,638	4,374,549	14,566,187
Value of sales	$1,785,988	$272,481	$2,058,469	$1,195,192	$415,866	$1,611,058
Light oil derivatives:						
Production gallons	203,825,926	4,725,157	208,551,083	187,347,936	3,372,267	190,720,203
Sales do	199,581,726	4,827,366	204,409,092	184,424,261	3,602,489	188,026,750
Value of sales	$39,384,467	$777,652	$40,162,119	$35,693,087	$558,680	$36,251,767
Naphthalene, crude:						
Production pounds	104,949,628	867,042	105,816,670	70,206,106	617,330	70,823,436
Sales do	101,960,448	867,042	102,827,490	59,290,360	617,330	59,907,690
Value of sales	$4,510,239	$35,628	$4,545,867	$2,626,688	$28,127	$2,654,815
All other coal-chemical materials, value	$15,528,208	$138,881	$15,667,089	$11,774,782	$144,796	$11,919,578

[1] Coke ovens built by city gas companies, some of which are operated in conjunction with coal- and water-gas plants. Does not include independent oven-coke plants that may sell gas to public-utility companies for distribution.

[2] Revised figures.

Copper

By Charles White Merrill and Helena M. Meyer

GENERAL SUMMARY

FOR several months after the first quarter of 1949 supplies of copper exceeded demand considerably in the United States. As a consequence, prices dropped, stocks rose, and production was curtailed. These months marked the first protracted period when supplies were more than adequate for all needs since the beginning of World War II. The recession in the copper industry accompanied the general industrial reaction. In recovering substantially in the late months of the year, copper followed the pattern for industry in general but made greater advances than many other commodities. For the year as a whole, mine production of copper dropped 10 percent, refinery output from domestic and foreign primary materials decreased 16 percent, apparent consumption of new copper fell 12 percent, total consumption of copper in the form of metal declined 17 percent, and the average quoted price for electrolytic copper was 13 percent less than in 1948.

At the beginning of 1949 demand considerably exceeded supply owing partly to the work stoppage at the Kennecott Copper Corp. Utah Copper mine, West Mountain (Bingham) district, Utah, largest producer in the United States, from October 24, 1948, to February 8, 1949. Because of this strike, production in 1948 was about 50,000 tons less and in 1949, 35,000 tons less than had been anticipated. Demand for copper was heavy during the first quarter, when according to records of the Copper Institute, 305,085 tons were delivered to customers; deliveries in the second quarter totaled 154,353 tons, little more than half as much. In the third quarter deliveries advanced to 239,170 tons and in the fourth to 332,987 tons, the highest quarterly total for the year. Refined-copper production was affected adversely in 1949 by the strike from June 30 to October 28 at the Carteret, N. J., plant of the American Metal Co.

The average quoted price for electrolytic copper, f. o. b. refinery, was 23.2 cents a pound from August 10, 1948, until the end of March 1949, when a decline of ½ cent a pound marked the beginning of a major downtrend. By the end of April the price was 19.7 cents and by the end of June 15.7 cents. An improvement in demand caused the price to turn upward in early July, and on November 3 it rose to 18.2 cents, where it continued beyond the year end.

After the collapse in demand and price in the second quarter, domestic production dropped. Mine output was 184,324 tons in January–March, 201,509 tons in April–June, 170,624 tons in July–September, and 196,293 tons in October–December. The curtailment in output, initiated on a large scale in May, was brought about chiefly by a reduction in the workweek from 48 to 40 hours at the leading copper-producing properties rather than by numerous mine closures, although some small mines ceased to produce. By the end

of 1949, operation on a 48-hour basis had been resumed at most properties.

Receipts of unmanufactured copper established a new high record in 1949, exceeding the previous peak in 1948 by 9 percent. Continuation of large imports despite the drop in demand caused dissatisfaction among the domestic mining companies that have no large foreign mining subsidiaries. In the late months of the year, after demand resumed large proportions, imports of substantial quantities of copper were again needed to fill total domestic requirements.

Legislation suspending the excise tax of 4 cents a pound on copper imported into the United States called for resumption of the tax after March 31, 1949, but the suspension was continued to June 30, 1950, by a bill signed by President Truman on March 31. On February 14, Chile's acceptance of the General Agreement on Tariffs and Trade, concluded by the United States and 22 other countries at Geneva on October 30, 1947, made a cut from 4 to 2 cents in the excise tax on copper effective when the tax suspension ended. As a result of the reduced demand for copper in the second quarter of 1949, there was agitation in Congress for withdrawal of the tax suspension, but the year closed without such action having been taken. Efforts to pass mine subsidy legislation in 1949 likewise were unsuccessful.

Exports of refined copper, by far the most important class, decreased 3 percent in 1949, marking a continuation of the downtrend in 1948.

Effects of the devaluation of the British pound and of other currencies, in mid-September, on world trade in copper and manufactures of copper, as well as on trade in other products, may not be determined for a long time.

The report of this series for 1948 outlined the plans in progress or prospect for major expansion or maintenance of current production rates. Construction on the "greater Butte project" of the Anaconda Copper Mining Co. proceeded on schedule through the first quarter of 1949; it was then suspended temporarily until the fourth quarter, when construction of surface facilities and preparations for mining were resumed. Construction of the new plant for treatment of sulfide ores at the Chuquicamata mine of the Chile Exploration Co., subsidiary of the Anaconda Copper Mining Co., proceeded throughout 1949, and the schedule calls for bringing the plant into operation in the first half of 1952. Total expenditures on this plant to the end of 1949 were $23,032,661, of which $19,493,338 was expended in 1949.

Exploration in 1949 at the White Pine, Mich., property of the Copper Range Co. added 50,000,000 tons of positive plus probable ore to reserves. Total reserves at the end of 1949 were 249,610,000 tons, containing 1.115 percent copper. Drilling at the property continued.

Construction of the new electrolytic refinery of the Kennecott Copper Corp. at Garfield, Utah, progressed during the year, and production of refined copper was expected soon after mid-1950. The planned capacity of 12,000 tons monthly, it is said, can readily be raised to 16,000 tons. Development and stripping operations preparatory to the initiation of open-pit mining at the Ray, Ariz., Division of Kennecott progressed in 1949 to a point permitting production of about 2,500 tons of pit ore a day. In mining part of the remaining tonnage

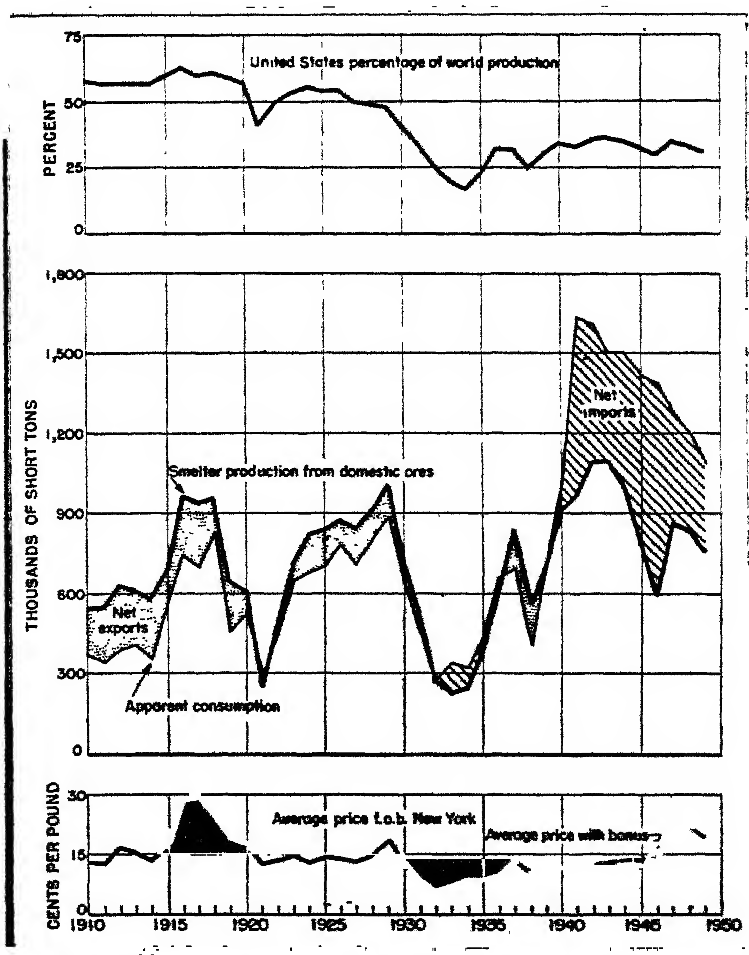

FIGURE 1.—Trends in production, consumption, and price of copper in the United States, 1910–49.

in the No. 1 ore body by open-cut methods, the company plans to expand daily mine and mill capacity from 6,000 to 15,000 tons of ore. Block caving will continue to be used at No. 2. Facilities at the Hayden, Ariz., smelter of the American Smelting & Refining Co. are being extended to treat the additional tonnages of concentrate.

The new smelter of the Phelps Dodge Corp. under construction at Ajo, Ariz., in 1949 will be ready for operation by the middle of 1950, if the current schedule is maintained. In recent years the New Cornelia pit at Ajo has been expanded [1] to permit increased production from about 22,000 to 28,000 tons of ore a day.

At the Inspiration Consolidated Copper Co. property in Arizona, open-pit operations were begun in 1948 to treat ores too thin and in

[1] Engineering and Mining Journal, Phelps Dodge Projects Assure Copper for Tomorrow: Vol. 150, No. 7, July 1949, p. 98.

some places too low grade to be mined by the block-caving system solely used previously at the mine. In 1949, the first full year of open-pit mining, 44 percent of the tonnage of copper ore mined was produced by this method.

Work at the San Manuel, Ariz., property consisted in sinking No. 1 shaft 1,145 to 1,270 feet by December 31, 1949 and No. 2 shaft 798 to 988 feet at the year end. Following completion of shaft sinking the program provides for lateral development at one or more levels. Preliminary designs of plant, townsite, and necessary transportation facilities are in course of preparation. Evidently no effort was made to extend the already reported developed reserves of 462,784,500 tons of ore, averaging 0.782 percent copper.

World mine output of copper was about 4 percent lower in 1949 than in 1948. The over-all decrease was brought about chiefly by declines in the United States, Chile, and Belgian Congo, too large to be counterbalanced by gains in Northern Rhodesia and Canada.

Salient statistics of the copper industry in the United States, 1940–44 (average) and 1945–49, in short tons

	1940–44 (average)	1945	1946	1947	1948	1949
New copper produced—						
From domestic ores, as reported by—						
Mines	995,933	772,894	608,737	847,563	834,813	752,750
Ore produced:						
Copper ore [1]	85,839,998	77,472,983	62,232,342	87,864,898	84,729,043	76,032,531
Average yield of copper, percent	1.09	.93	.91	.90	.92	.91
Smelters	1,011,893	782,726	599,656	862,872	842,477	757,931
Percent of world total	34	33	29	35	33	29
Refineries	1,004,674	775,738	578,429	909,213	860,022	695,015
From foreign ores, matte, etc., refinery reports	340,101	332,861	300,233	250,757	247,424	232,912
Total new refined, domestic and foreign	1,344,775	1,108,599	878,662	1,159,970	1,107,446	927,927
Secondary copper recovered from old scrap only	411,588	497,096	406,453	503,376	505,464	383,548
Copper content of copper sulfate produced by refiners	7,328	8,237	5,070	6,161	6,132	4,842
Total production, new and old and domestic and foreign	1,763,691	1,613,931	1,290,185	1,669,507	1,619,042	1,316,317
Imports (unmanufactured) [2]	698,617	853,196	[3] 396,335	[3] 413,890	[3] 507,449	552,704
Refined [2]	342,285	531,367	154,371	[3] 149,478	249,134	275,811
Exports of metallic copper [4]	265,815	132,555	97,475	196,999	[3] 207,022	195,990
Refined (ingots, bars, rods, etc.)	173,987	53,572	[5] 52,629	[5] 147,642	[5] 142,598	137,827
Stocks at end of year	334,600	461,000	350,000	273,000	250,000	322,000
Refined copper	80,500	130,000	96,000	60,000	67,000	61,000
Blister and materials in solution	254,100	331,000	254,000	213,000	183,000	261,000
Withdrawals from total supply on domestic account:						
Total new copper	1,453,000	1,415,000	1,391,000	1,286,000	1,214,000	1,072,000
Total new and old copper (old scrap only)	1,865,000	1,912,000	1,797,000	1,789,000	1,719,000	1,456,000
Price average [6] ....cents per pound	11.7	11.8	14.4	20.9	21.7	19.7
World smelter production, new copper	2,915,000	2,438,000	2,070,000	2,525,000	2,639,000	2,649,000

[1] Includes old tailings.
[2] Data include copper imported for immediate consumption plus material entering country under bond.
[3] Revised figure.
[4] Total exports of copper, exclusive of ore concentrates, composition metal, and unrefined copper. Exclusive also of "Other manufactures of copper," for which figures of quantity are not recorded.
[5] Excludes rods.
[6] Exclusive of bonus payments of the Office of Metals Reserve; Premium Price Plan covered the period February 1, 1942, to June 30, 1947, inclusive.

Northern Rhodesian operations continued to be hampered by inadequate transportation facilities and a consequent shortage of coal. More intensive wood burning in 1949, however, permitted increased production compared with 1948. Production in Belgian Congo was curtailed owing to a shortage of power caused by a drought and by insufficient coal. Initial production at the Quemont and East Sullivan mines in Canada was a factor in the increased output for that country. All three major producers in Chile shared the decrease in the production for that country compared with 1948.

The following Bureau of Mines reports of investigations, published recently, relate to copper in whole or in part.

4431. Copper-Nickel Deposits of the Stillwater Complex, Stillwater and Sweetgrass Counties, Mont.
4492. Scarlet Copper Mine, Randolph County, N. C.
4494. Copper-Bearing Pyrite Ores, Pyriton, Clay County, Ala.
4504. Keystone and St. George Copper-Zinc Deposits, Cochise County, Ariz.
4544. Rambler Copper Mine, Albany County, Wyo.
4579. Boston Consolidated Copper Mine, Salt Lake County, Utah.
4612. Chloride Volatilization and Other Tests on a Gold-Copper Ore.
4617. Table Mountain Copper Deposit, Churchill County, Nev.
4665. Magruder and Chambers Copper Deposits, Lincoln and Wilkes Counties, Ga.
4666. Perkiomen Creek Copper Deposits, Montgomery County, Pa.
4691. Tapley Copper Deposit, Hancock, Maine.
4694. Cove Meadow Copper Deposit, Humboldt, Nev.

The following Bureau of Mines information circulars likewise discussed copper.

7501. Safety Practices at United Verde Mine, Phelps Dodge Corp., Jerome, Ariz.
7502. Mining Methods and Costs at the Atwood Copper Mine, Lordsburg Mining District, Hidalgo County, N. Mex.
7536. History of Premium Price Plan for Copper, Lead and Zinc, 1942–47, by H. E. Olund and S. A. Gustavson.
7548. Safety Practices in Churn Drilling at Morenci Branch, Phelps Dodge Corp., Morenci, Ariz.

DOMESTIC PRODUCTION

Statistics on copper production may be compiled upon a mine, smelter, or refinery basis. Mine data are most accurate for showing the geographic distribution of production; smelter figures are better than mine figures for showing the actual recovery of metal and more accurate than refinery figures for showing the source of production; and refinery statistics are best for showing recovery of metal but indicate only in a general way the source of crude materials treated. Mineral Resources of the United States, 1930, part I (pp. 701–702), discusses differences among the three sets of figures.

Copper produced from domestic ores, as reported by mines, smelters, and refineries, 1945–49, in short tons

Year	Mine	Smelter	Refinery
1945	772,894	782,726	[illegible]
1946	608,737	599,656	[illegible]
1947	847,563	863,872	[illegible]
1948	834,813	842,477	[illegible]
1949	752,750	757,931	[illegible]

PRIMARY COPPER

Mine Production.—The figures for mine production are tabulated from reports supplied by all domestic mines that produce copper. These data are classified geographically, by metallurgical methods, and by types of ore. Tables presenting the information in detail are to be found in the State chapters of this volume.

As usual, Arizona led all other States by a wide margin in production in 1949, supplying nearly 48 percent of the total for the United States, followed by Utah, with 26 percent. Arizona's output comes from a number of important copper-producing districts and mines, whereas Utah's is predominantly from one mine, the largest copper producer in the United States. Production from Montana, New Mexico, Nevada, and Michigan, ranking next in importance as copper producers in 1949, made up 23 percent of the total. These six States produced 96 percent of the United States total in 1949 and 97 percent in 1948.

Classification of production by mining methods shows that approximately 70 percent of the total copper and 78 percent of the copper ore came from open pits in 1949. Most of the domestic copper ore was treated by flotation at or very near the mine of origin, and the resulting concentrates were shipped for smelting. Some copper ores were direct-smelted either because of their high grade or because of their fluxing qualities.

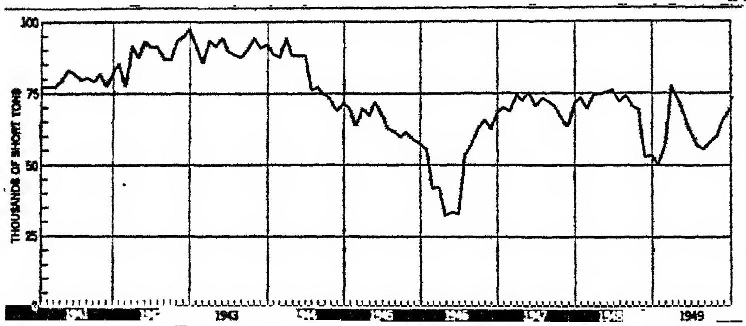

FIGURE 2.—Mine production of recoverable copper in the United States, 1941–49, by months, in short tons.

Mine production of recoverable copper in the United States, in 1949, by months [1]

Month	Short tons	Month	Short tons
January	50,002	August	55,898
February	56,410	September	58,111
March	77,912	October	60,515
April	72,843	November	66,044
May	67,412	December	69,734
June	61,254		
July	56,615	Total	752,750

[1] Monthly figures adjusted to final annual mine production total.

Mine production of recoverable copper in the United States, 1939–49, with production of maximum year, and cumulative production from earliest record to end of 1949, by States, in short tons

State	Maximum production [1]		Production by years											Total production from earliest record to end of 1949
	Year	Quantity	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	
Western States and Alaska:														
Alaska	1916	59,927	128	55	72	22	27	2	5	2	12	16	4	685,898
Arizona	1929	415,314	262,112	281,169	326,317	393,387	403,181	358,303	287,203	289,223	366,218	375,121	359,010	12,278,441
California	1909	28,644	4,180	6,438	3,943	1,058	8,762	12,721	6,473	4,240	2,407	481	649	629,361
Colorado	1938	14,171	13,215	12,152	6,748	1,102	1,028	1,048	1,485	1,754	2,150	2,298	2,403	257,562
Idaho	1907	5,445	2,516	3,349	3,621	3,430	2,324	1,688	1,548	1,038	1,040	1,624	1,438	112,489
Montana	1916	176,464	97,827	126,391	128,036	141,194	134,525	118,190	88,506	58,481	57,900	58,252	50,611	6,751,116
Nevada	1942	83,663	66,597	78,454	78,911	83,663	71,068	61,232	52,595	48,616	49,603	45,242	38,058	1,915,571
New Mexico	1942	80,100	40,142	69,848	73,478	80,100	76,163	69,730	56,571	50,191	60,205	74,687	55,388	1,540,479
Oregon	1916	1,791	48	88	83	103	6	3	1	7	14	2	20	12,379
South Dakota	1918	32		6		1		1						106
Texas	1928	224	84	30	6	99	81	115	55	3	6	23	24	1,362
Utah	1943	323,989	171,890	231,864	266,838	306,691	323,989	282,575	220,376	114,284	266,533	227,007	197,245	5,591,226
Washington	1940	9,612	8,998	9,612	8,680	8,030	7,315	6,169	5,821	4,527	2,240	5,665	5,275	92,106
Wyoming	1900	2,102		2	4					1				16,326
Total			673,687	819,458	896,743	1,018,880	1,028,469	911,777	720,039	572,367	808,928	790,418	716,125	29,884,422
West Central States:														
Missouri	1949	3,670		685	1,400	1,300	1,340	3,302	3,309	1,857	1,760	2,370	3,670	[2] 27,478
States east of the Mississippi:														
Alabama	1907	42												(3)
Georgia	1917	465		13										(3)
Maine	1918	383												(3)
Maryland	1917	146												(3)
Massachusetts	1906	5												(3)
Michigan	1916	136,846	43,985	45,198	46,440	45,679	46,764	42,421	30,401	21,663	24,184	27,777	19,506	4,890,957
New Hampshire	1908	[4] 94												(3)
North Carolina	1930	(5)	(6)	(6)	(6)	(6)	(6)	(6)						(3)
Pennsylvania	1942	(5)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(3)
South Carolina	(3)	(5)		(7)	(7)	(7)	(7)							(3)
Tennessee	1930	(5)	[6] 10,648	[6] 12,732	[6] 13,566	[6] 14,174	[6] 13,855	[6] 12,860	[6] 12,385	[6] 12,850	[6] 12,686	[6] 14,248	[6] 13,449	(3)
Vermont	1946	(5)					290	1,898	(6)	(6)	(6)	(6)	(6)	(3)
Virginia	1944	291				28	100	291	70		5			(3)
Wisconsin	1914	5												(2)
Total			54,633	57,943	60,006	59,881	61,009	57,470	42,856	34,513	36,875	42,025	32,955	[8] 5,500,489
Grand total	1943	1,090,818	728,320	878,086	958,149	1,080,061	1,090,818	972,549	772,894	608,737	847,563	834,813	752,750	[9] 35,412,389

[1] For Missouri and States east of the Mississippi, maximum since 1905.
[2] Small quantity for Wisconsin included with Missouri.
[3] Data not available.
[4] The 1908 volume of Mineral Resources credits this figure to Massachusetts and New Hampshire; the 1909 volume credits it to New Hampshire alone.
[5] Bureau of Mines not at liberty to publish figure.
[6] Tennessee includes other States indicated by footnote 6; Bureau of Mines not at liberty to publish separate figures.
[7] Less than 1 ton.
[8] For States other than Michigan, figures represent largely smelter output. Excludes small quantity, not separable, for Wisconsin shown with Missouri.
[9] Largely smelter production for States east of the Mississippi except Michigan.

Mine production of copper in the principal districts [1] of the United States, 1940–44 (average) and 1945–49, in terms of recoverable copper, in short tons

District or region	State	1940–44 (average)	1945	1946	1947	1948	1949
West Mountain (Bingham)	Utah	280,249	224,284	112,083	264,315	225,225	196,101
Copper Mountain (Morenci)	Arizona	55,802	100,826	95,366	147,899	148,316	141,934
Globe-Miami	do	88,582	78,646	88,556	91,032	88,478	80,189
Ajo	do	60,082	37,950	45,233	49,687	55,615	58,350
Summit Valley (Butte)	Montana	128,831	87,948	57,905	57,187	57,712	55,945
Central (including Santa Rita)	New Mexico	68,318	[2] 55,197	[2] 48,806	57,071	[2] 72,784	[2] 53,276
Robinson (Ely)	Nevada	64,963	49,175	45,777	47,524	44,491	37,533
Pioneer (Superior)	Arizona	17,962	8,365	12,244	15,922	18,720	21,616
Lake Superior	Michigan	45,300	30,401	21,663	24,184	27,777	19,506
Mineral Creek (Ray)	Arizona	37,875	19,671	16,355	18,935	18,753	18,595
Verde (Jerome)	do	36,772	20,112	16,176	14,603	14,544	17,215
Warren (Bisbee)	do	49,719	12,567	4,605	17,059	19,204	9,840
Eureka (Bagdad)	do	2,178	4,106	5,932	6,491	7,247	7,906
Chelan Lake	Washington	7,789	5,803	4,494	2,214	5,654	[3] 5,249
Southeastern Missouri	Missouri	1,605	3,399	1,857	1,760	2,370	3,670
San Juan Mountains	Colorado	704	1,018	1,333	1,430	1,865	1,974
Lordsburg	New Mexico	3,045	1,146	1,196	1,770	1,708	1,934
Coeur d'Alene	Idaho	2,386	1,018	810	1,312	1,388	1,171
Cochise	Arizona	77	493	987	1,036	968	689
Cope	Nevada	(4)	(4)	(4)	1,105	14	[5] 13
Ione	California	110	827	1,004	837		
Copperopolis	do	863	1,123	91	(4)		
Klamath River	do	2,592	1,526				
Burro Mountain	New Mexico	1,631	(2)	(2)	1,140	(2)	(2)
Flat Creek [6]	California	(4)	1,843	(4)	698	(4)	(4)
Lebanon (Cornwall mine) [6]	Pennsylvania	(4)	(4)	(4)	(4)	(4)	(4)
Ducktown [6]	Tennessee	(4)	(4)	(4)	(4)	(4)	(4)
Orange County [6]	Vermont	(4)	(4)	(4)	(4)	(4)	(4)

[1] Districts producing 1,000 short tons or more in any year of the period 1945–49.
[2] Burro Mountain included with Central. Bureau of Mines not at liberty to publish separate figures.
[3] Includes Peshastin Creek and Wenatchee. Bureau of Mines not at liberty to publish separate figures.
[4] Bureau of Mines not at liberty to publish figures.
[5] Includes Van Duzer. Bureau of Mines not at liberty to publish separate figures.
[6] Not listed in order of output.

Rank	Mine	District	State	Operator	Source of copper
1	Utah Copper	West Mountain (Bingham)	Utah	Kennecott Copper Corp	Copper ore.
2	Morenci	Copper Mountain (Morenci)	Arizona	Phelps Dodge Corp	Do.
3	New Cornelia	Ajo	do	do	Do.
4	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper, zinc-lead ores.
5	Chino Mines	Central	New Mexico	Kennecott Copper Corp	Copper ore.
6	Inspiration	Globe-Miami	Arizona	Inspiration Consolidated Copper Co	Do.
7	Ruth & Copper Flat Pit	Robinson (Ely)	Nevada	Kennecott Copper Corp	Do.
8	Miami	Globe-Miami	Arizona	Miami Copper Co	Do.
9	Castle Dome	do	do	Castle Dome Copper Co., Inc	Do.
10	Magma	Pioneer (Superior)	do	Magma Copper Co	Do.
11	Ray Mines	Mineral Creek (Ray)	do	Kennecott Copper Corp	Do.
12	United Verde	Verde (Jerome)	do	Phelps Dodge Corp	Copper, zinc-copper ores.
13	Calumet & Hecla Cons	Lake Superior	Michigan	Calumet & Hecla Cons. Copper Co	Copper ore and tailings.
14	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp	Copper, zinc-lead ores.
15	Consolidated Coppermines group	Robinson (Ely)	Nevada	Consolidated Coppermines Corp	Copper ore.
16	Bagdad	Eureka (Bagdad)	Arizona	Bagdad Copper Corp	Do.
17	Burra Burra, Eureka, Boyd, Mary, Calloway.	Polk County	Tennessee	Tennessee Copper Co	Copper-bearing pyrites.
18	Holden	Chelan Lake	Washington	Howe Sound Co	Zinc copper ore.
19	Cornwall	Lebanon County	Pennsylvania	Bethlehem Steel Co	Magnetite - pyrite - chalcopyrite ore.
20	Elizabeth	Orange County	Vermont	Vermont Copper Co	Copper ore.
21	Quincy	Lake Superior	Michigan	Quincy Mining Co	Copper-ore tailings.
22	Bonney-Miser's Chest	Lordsburg	New Mexico	Banner Mining Co	Copper ore.
23	Champion	Lake Superior	Michigan	Copper Range Co	Do.
24	Treasury Tunnel-Black Bear	Upper San Miguel	Colorado	Idarado Mining Co	Zinc-lead-copper ore.
25	United States & Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co	Zinc-lead, gold-silver, silver ores.

The first 5 mines in the foregoing table produced 67 percent of the United States total, 10 produced 84 percent, and the entire 25 furnished 98 percent.

Quantity and Estimated Recoverable Content of Copper-Bearing Ores.—The following tables list the quantity and estimated recoverable copper content of the ore produced by mines in the United States in 1948 and 1949. Of the total copper produced from copper ores in the United States during 1949 (1948 data in parentheses), 93 (91) percent was obtained from ores concentrated before smelting, 3 (4) percent from direct-smelting ores, and 4 (5) percent from ore treated by straight leaching.

Copper ore, old tailings, etc., sold or treated in the United States in 1948–49, with copper, gold, and silver content in terms of recoverable metals

State	Ore, old tailings, etc., sold or treated (short tons)	Copper produced		Gold produced (fine ounces)	Silver produced (fine ounces)	Value of gold and silver per ton of ore
		Pounds	Percent			
1948						
Alaska	14	2,800	10.00	5	25	$14.14
Arizona	39,072,204	[1] 725,032,285	.93	84,391	2,814,833	.14
California	152	[1] 19,400	6.38	2	194	1.62
Colorado	5,831	364,748	3.13	538	123,877	22.46
Idaho	1,383	170,674	6.17	38	2,464	2.57
Michigan	4,490,236	55,554,000	.62			
Montana	1,511,069	[1] 105,639,446	3.50	10,888	1,894,759	1.39
Nevada	6,209,049	[1] 87,250,000	.70	37,385	142,435	.23
New Mexico	7,139,147	[1] 109,014,975	.76	1,998	166,018	.03
Oregon						
Texas	957	44,000	2.30		180	.17
Utah	24,458,362	[1] 433,458,711	.89	312,536	2,649,771	.55
Washington [2]	608,915	11,320,700	.93	41,828	137,989	2.61
East of the Mississippi (except Michigan)	1,231,724	[3] 28,496,000		260	64,602	
Total	[2] 84,729,043	[3] 1,556,367,739	.92	489,869	7,997,147	.29
1949						
Alaska						
Arizona	37,365,611	[1] 683,129,855	0.91	78,735	2,412,359	0.13
California	250	[1] 30,400	6.08	35	1,256	9.45
Colorado	3,838	233,625	3.04	296	59,069	16.63
Idaho	384	82,510	10.74	10	554	2.22
Michigan	3,542,868	39,012,000	.55			
Montana	1,231,266	[1] 101,289,540	4.11	5,027	1,845,783	1.50
Nevada	4,897,598	[1] 74,197,100	.76	38,135	133,910	.30
New Mexico	6,105,174	[1] 79,160,743	.65	2,304	155,094	.04
Oregon	46	5,800	6.30	2	22	1.96
Texas	1,249	46,000	1.84		81	.08
Utah	20,924,274	[1] 374,421,560	.89	267,891	2,233,708	.54
Washington [2]	627,422	10,526,700	.84	42,974	131,839	2.59
East of the Mississippi (except Michigan)	1,332,551	[3] 26,898,000		291	69,279	
Total	[2] 76,032,531	[3] 1,389,033,833	.91	435,700	7,042,954	.28

[1] Excludes copper recovered from precipitates as follows: 1948: Arizona, 16,874,713 pounds; California, 52,000 pounds; Montana, 5,503,688 pounds; Nevada, 2,055,200 pounds; New Mexico, 38,937,830 pounds; Utah, 15,658,743 pounds. 1949: Arizona, 19,923,626 pounds; California, 60,100 pounds; Montana, 4,419,019 pounds; Nevada, 1,038,400 pounds; New Mexico, 30,789,314 pounds; Utah, 15,822,418 pounds.

[2] Includes ore from Washington classed as zinc-copper ore and copper, gold and silver recovered therefrom.

[3] Copper from magnetite-pyrite-chalcopyrite ore included with that from copper ore.

Close agreement between the output as reported by smelters and the recoverable quantity as reported by mines indicates that estimated recoverable tenor is close to actual recovery. Classification of some of the complex western ores is difficult and more or less abitrary. "Copper ores" include not only all those that contain 2.5 percent or more recoverable copper but also those that contain less than this percentage if they are valuable chiefly for copper, notably the "porphyry ores." Mines report considerable copper from ores mined primarily for other products. These include siliceous gold and silver ores, lead and zinc ores, and pyritic ores.

Copper ore, old tailings, etc., concentrated in the United States in 1948–49, with content in terms of recoverable copper

1948			
Arizona	[1] 34,632,227	[2] 594,377,003	0.86
Colorado	177	13,480	3.81
Idaho	352	10,700	1.52
Michigan	4,490,236	55,554,000	.62
Montana	1,500,006	104,994,734	3.50
Nevada	6,164,875	85,881,100	.70
New Mexico	7,025,421	107,011,066	.76
Utah	24,454,125	432,515,056	.88
Washington [3]	608,863	11,315,600	.93
East of the Mississippi (except Michigan)	1,221,814	[4] 28,422,000	
Total	80,098,098	1,420,094,739	.89
1949			
Arizona	[1] 33,528,676	[2] 587,407,347	0.88
Colorado			
Idaho	50	2,345	2.35
Michigan	3,542,868	39,012,000	.55
Montana	1,204,471	98,984,018	4.11
Nevada	4,847,536	73,098,300	.75
New Mexico	6,013,122	77,481,222	.64
Utah	20,922,420	373,960,201	.89
Washington [3]	627,316	10,498,200	.84
East of the Mississippi (except Michigan)	1,332,551	[4] 26,898,000	1.01
Total	72,019,010	1,287,341,633	.89

[1] In addition, 3,753,197 tons were treated by straight leaching in 1948, and 3,366,001 tons in 1949.
[2] In addition, 69,834,970 pounds of copper were recovered by straight leaching in 1948, and 57, pounds in 1949.
[3] Zinc-copper ore.
[4] Includes copper from magnetite-pyrite-chalcopyrite ore.

Copper ore, old tailings, etc., smelted in the United States in 1948–49, with content in terms of recoverable copper, and copper produced from all sources, in terms of recoverable copper

State	Ore, old tailings, etc., smelted			Copper from all sources, including old slags, smelter cleanings, and precipitates (pounds)
	Short tons	Copper produced (pounds)	Percent of copper	
1948				
Alaska	14	2,800	10.00	32,000
Arizona	686,780	60,820,312	4.43	[1] 750,242,000
California	152	19,400	6.38	[2] 962,000
Colorado	5,654	351,268	3.11	4,596,000
Idaho	1,031	159,974	7.76	3,248,000
Michigan				55,554,000
Missouri				4,740,000
Montana	11,061	644,712	2.91	[1] 116,504,000
Nevada	44,174	1,368,900	1.55	[1] 90,484,000
New Mexico	113,726	2,003,909	.88	[1] 149,374,000
Oregon				4,000
Texas	957	44,000	2.30	46,000
Utah	4,237	943,655	1.11	[1] 454,014,000
Washington	52	5,100	4.90	11,330,000
East of the Mississippi (except Michigan)	9,910	74,000	.37	28,496,000
Total	877,748	66,438,030	3.78	1,669,626,000
1949				
Alaska				8,000
Arizona	468,934	38,694,396	4.13	[1] 718,020,000
California	250	30,400	6.08	[2] 1,298,000
Colorado	3,838	233,625	3.04	4,806,000
Idaho	334	80,165	12.00	2,876,000
Michigan				39,012,000
Missouri				7,340,000
Montana	26,795	2,305,522	4.30	[1] 113,222,000
Nevada	50,062	1,098,800	1.10	[1] 76,116,000
New Mexico	92,052	1,679,521	.91	[1] 110,776,000
Oregon	46	5,800	6.30	40,000
Texas	1,249	46,000	1.84	48,000
Utah	1,854	461,359	12.44	[1] 394,490,000
Washington	106	28,500	13.44	10,550,000
East of the Mississippi (except Michigan)				26,898,000
Total	645,520	44,664,088	3.46	1,505,500,000

[1] Considerable copper was recovered from precipitates.
[2] Mostly from ores not classed as copper ores.

Copper ores produced in the United States, 1940–44 (average) and 1945–49, and average yield in copper, gold, and silver

Year	Smelting ores [1]		Concentrating ores [1]		Total				
	Short tons	Yield in copper (percent)	Short tons	Yield in copper (percent)	Short tons [1]	Yield in copper (percent)	Yield per ton in gold (ounce)	Yield per ton in silver (ounce)	Value per ton in gold and silver
1940–44 (average)	2,045,202	4.03	80,187,373	1.01	85,839,998	1.09	0.0062	0.187	$0.35
1945	1,036,847	3.52	73,958,665	.90	[2] 77,472,983	.93	.0051	.119	.26
1946	742,666	3.12	58,520,635	.88	[2] 62,232,342	.91	.0046	.091	.23
1947	910,018	3.66	83,283,080	.87	[2] 87,864,898	.90	.0058	.095	.29
1948	877,748	3.78	80,096,098	.89	[2] 84,729,043	.92	.0058	.094	.29
1949	645,520	3.46	72,019,010	.89	[2] 76,032,531	.91	.0057	.093	.28

[1] Includes old tailings, etc.
[2] Includes ore from Washington classed as zinc-copper ore.

Smelter Production.—The recovery of copper by smelters in the United States from ores of domestic origin totaled 757,931 short tons in 1949, a 10-percent decrease from the total of 842,477 tons for 1948. Such output constituted 51 percent of the world production during 1925–29 but dropped sharply in the succeeding years until 1934, when it was only 17 percent. From 1936 to 1940 it fluctuated between 25 and 33 percent, in 1942–44 it was slightly above 35 percent, and in 1945–49 it ranged from 29 to 35 percent.

The figures for smelter production are based upon returns from all smelters handling copper-bearing materials produced in the United States. For Michigan the sum of furnace-refined copper and copper cast into anodes for electrolytic refining is included. The figures for blister copper represent the fine-copper content. Some casting and electrolytic copper produced direct from ore or matte is included in the smelter production as well as in the refinery output. Metallic and cement copper recovered by leaching is included in smelter production.

The quantity, in pounds, of copper produced by smelters in the United States and its value are shown by years for 1845–1930 in Mineral Resources of the United States, 1930, part I (p. 703).

Copper produced (smelter output) in the United States, 1940–44 (average) and 1945–49, and total, 1845–1949

Year	Short tons	Value [1]
1940–44 (average)	1,011,893	$236,988,000
1945	782,726	184,723,000
1946	599,656	172,701,000
1947	862,872	360,680,000
1948	842,477	365,635,000
1949	757,931	298,625,000
Total, 1845–1949	35,494,521	10,613,874,000

[1] Excludes bonus payments of Office of Metals Reserve; Premium Price Plan in effect Feb. 1, 1942, to June 30, 1947.

Refinery Production.—The refinery output of copper in the United States in 1949 was made by 12 plants; 8 of these employed the electrolytic method only, 2 the furnace process on Lake Superior copper, 1 the furnace process on western ores, and 1 both the electrolytic and the furnace methods.

Five large electrolytic refineries are on the Atlantic seaboard, three Lake refineries on the Great Lakes, and three electrolytic refineries west of the Great Lakes—one at Great Falls, Mont.; one at Tacoma, Wash.; and one at El Paso, Tex. In 1942 fire-refined copper was produced for the first time at the Hurley, N. Mex., plant of the Kennecott Copper Corp., and virtually all of the plant output was treated by this method in 1949. The El Paso plant of the Phelps Dodge Refining Corp. produced fire-refined copper in addition to the electrolytic grade. Of the plants specified above, the Lake refinery of the Copper Range Co. has been idle since October 9, 1945. That of the Quincy Mining Co., idle since 1933, was reopened in the final quarter of 1948 and continued to produce through 1949. As a result of a strike at the Carteret operation of the U. S. Metals Refining Co., the refinery was idle from June 30 to October 28.

In addition to the plants in the preceding paragraph, but included in the 12 active refineries noted, is the plant at Inspiration, Ariz., which is equipped to make electrolytically refined copper direct from the liquors obtained from leaching ore. Usually all of this copper is shipped as cathodes to other refineries, where it is melted and cast into merchant shapes; but in 1946 more than one-third went directly to consuming plants. The latter practice was continued in 1947 and 1948, but on a considerably reduced scale, and virtually ceased in 1949.

Primary and secondary copper produced by primary refineries in the United States and imported, 1940–44 (average) and 1945–49, in short tons

	1940–44 (average)	1945	1946	1947	1948	1949
Primary:						
Domestic: [1]						
Electrolytic [2]	910,463	669,705	475,571	805,718	745,102	606,826
Lake [3]	44,463	29,995	21,567	23,998	26,511	17,608
Casting	49,748	76,038	81,291	79,497	88,409	70,581
Total	1,004,674	775,738	578,429	909,213	860,022	695,015
Foreign: [1]						
Electrolytic	338,914	298,128	300,233	250,757	247,424	232,912
Casting and best select	1,187	34,733				
Refinery production, new copper	1,344,775	1,108,599	878,662	1,159,970	1,107,446	927,927
Imports, refined copper [3]	342,385	531,367	154,371	[4] 149,478	249,124	275,811
Total new refined copper made available	1,687,160	1,639,966	1,033,033	[4] 1,309,448	1,356,570	1,203,738
Secondary:						
Electrolytic [5]	97,769	[6] 84,044	[6] 97,615	[6] 249,560	[6] 222,602	[6] 196,850
Casting	4,501	12,618	7,957	19,525	22,774	15,542
Total	102,270	96,662	105,572	269,085	245,376	212,392
Grand total	1,789,430	1,736,628	1,138,605	[4] 1,578,533	1,601,946	1,416,130

[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as accurate separation at this stage of manufacture is not possible.
[2] Some copper from Michigan is electrolytically refined at eastern refineries and is included as electrolytic copper.
[3] Data include copper imported for immediate consumption plus material entering country under bond.
[4] Revised figure.
[5] Includes some secondary Lake copper.
[6] Copper from scrap at Lake refineries included under "casting" copper in 1945–49.

The 13 plants indicated constitute what commonly are termed "regular refineries." Of these plants, eight employ the electrolytic process, four the furnace process, and one both methods. The electrolytic plants, exclusive of the one at Inspiration, have a rated capacity of 1,518,000 tons of refined copper a year. They produced at the rate of 68 percent of capacity in 1949.

The accompanying tables show the production of refined copper at regular refining plants, classified according to source, grade, and form in which cast.

Copper cast in forms at primary refineries in the United States, 1947–49

Form	1947		1948		1949	
	Short tons	Percent	Short tons	Percent	Short tons	Percent
Wire bars	885,000	62	783,000	58	665,000	59
Cathodes	87,000	6	76,000	5	128,000	11
Ingots and ingot bars	99,000	7	148,000	11	117,000	10
Billets	160,000	11	187,000	14	108,000	10
Cakes	178,000	13	134,000	10	106,000	9
Other forms	20,000	1	25,000	2	16,000	1
Total	1,429,000	100	1,353,000	100	1,140,000	100

In addition to the regular refineries, many plants throughout the country operate on scrap exclusively, producing metallic copper and a variety of alloys. The output of these plants is not included in the statements of refined-copper production in the preceding tables but is included in the following statement on secondary-copper production.

Copper Sulfate.—The production of hydrous copper sulfate or bluestone by copper refineries in the United States was 19,400 short tons having a copper content of 4,842 tons in 1949 compared with 24,500 tons containing 6,132 tons in 1948. The output of copper sulfate by plants other than the regular primary refineries totaled 59,600 tons with a reported content of 14,907 tons in 1949 compared with 72,200 tons containing 18,054 tons of copper in 1948. Producers held 11,800 tons of copper sulfate at the beginning of 1949, total production was 79,000 tons, and shipments amounted to 84,400 tons. Some small purchases were made by producers during the year, and producers used a quantity equivalent to 0.4 percent of shipments. Inventories at the year end were 6,400 tons.

SECONDARY COPPER

Copper recovered from copper scrap, copper-alloy scrap, and other copper-bearing scrap materials, as metal, as copper alloys without separation of the copper, or as copper compounds is known as secondary copper. Quantities are reported in terms of copper content. Secondary copper is produced from new and from old scrap. "New scrap" is defined as refuse produced during manufacture of articles for ultimate consumption, including defective finished or semifinished articles that must be reworked. Typical examples of new scrap are defective castings, clippings, punchings, turnings, borings, skimmings, drosses, and slag. "Old scrap" consists of metal articles that have been discarded after serving a useful purpose. Such articles may be worn out, obsolete, or damaged. Typical examples are discarded trolley wire, fired cartridge cases, used pipe, and lithographers' plates.

The following table summarizes the production of secondary copper during 1940–49. Detailed information appears in the Secondary Metals—Nonferrous chapter of this volume.

Secondary copper produced in the United States, 1940–44 (average) and 1945–49, in short tons

	1940–44 (average)	1945	1946	1947	1948	1949
Copper recovered as unalloyed copper	132,275	112,856	136,909	303,092	284,026	250,089
Copper recovered in alloys [1]	712,362	893,660	666,637	658,649	688,762	463,054
Total secondary copper	844,637	1,006,516	803,546	961,741	972,788	713,143
From new scrap	433,049	509,421	397,093	458,365	467,324	329,595
From old scrap	411,588	497,095	406,453	503,376	505,464	383,548
Percentage equivalent of domestic mine output	85	130	132	113	117	95

[1] Includes copper in chemicals, as follows: 1940–44 (average), 12,613; 1945, 18,666; 1946, 19,192; 1947, 18,838; 1948, 17,612; 1949, 14,840.

CONSUMPTION

The following table gives figures on apparent consumption of copper in the United States; data for a long period are available on this basis. In estimating apparent consumption, it has been assumed that copper used in manufacturing primary fabrications of copper is consumed. The method of calculating the quantity of copper available for consumption is shown in the accompanying table. It should be noted that exports and stocks include some refined secondary copper that cannot be determined separately and also that actual consumption of new copper would differ from the figures shown in the table by changes in consumers' stocks. Actual consumption of new copper had been at virtually constant rates, at peacetime peak levels, in the postwar period until 1949, when it dropped 12 percent. The apparent consumption calculation is distorted in 1947 and 1948 by the fact that during this period unusual quantities of copper were imported in the form of scrap and reexported in refined form. Because refined exports cannot be broken down to show new and old copper, deductions were made from apparent consumption without making corresponding additions to supply. The drop in 1949, thus, was probably somewhat larger than indicated by the accompanying table.

New refined copper withdrawn from total year's supply on domestic account 1945–49, in short tons

	1945	1946	1947	1948	1949
Total supply of new copper	1,639,966	1,033,033	1,309,448	1,356,570	1,203,738
Stock at beginning of year	81,000	130,000	96,000	60,000	67,000
Total available supply	1,720,966	1,163,033	1,405,448	1,416,570	1,270,738
Copper exported [1]	48,563	52,629	147,642	142,598	137,827
Stock at end of year	130,000	96,000	60,000	67,000	61,000
Total	178,563	148,629	207,642	209,598	198,827
Withdrawn on domestic account [2]	1,415,000	1,391,000	1,286,000	[3] 1,214,000	[3] 1,072,000

[1] Includes refined copper in ingots, bars, or other forms.
[2] Adjusted for Office of Metals Reserve stock changes; OMR stocks consigned to National Stockpile late in 1948.
Includes copper delivered by industry to the National Stockpile.

The Bureau of Mines began to compile figures on actual consumption of copper in 1945. Details for 1947 to 1949, inclusive, are shown in the accompanying table. Unlike the foregoing table, which attempts to eliminate all but new copper from measurement, the following one does not distinguish between new and old copper. It covers copper consumed in refined form.

The heavy consumption of wire bars in the 3 years is noteworthy. Actual consumption of refined copper declined 17 percent, a greater drop than is shown by data on apparent consumption of new metal.

Refined copper consumed in 1947–49, by classes of consumers, in short tons

Class of consumer						Other	Total
1947:							
Wire mills	2,550	757,529	17,633			52	777,764
Brass mills	68,427	67,065	117,936	222,203	173,124	4	648,759
Chemical plants	59		251			1,662	1,972
Secondary smelters	4,107		3,074	279	166	197	7,823
Foundries and miscellaneous	1,924	23	20,299	113	489	4,128	26,976
Total	77,067	824,617	159,193	222,595	173,779	6,043	1,463,294
1948:							
Wire mills	13	743,403	22,390			43	765,849
Brass mills	79,235	62,454	92,889	209,861	169,875		614,314
Chemical plants	45		655		5	2,524	3,229
Secondary smelters	4,847		1,411	242	178	127	6,805
Foundries and miscellaneous	1,585	216	23,530	67	355	4,634	30,387
Total	85,725	806,073	140,875	210,170	170,413	7,328	1,420,584
1949:							
Wire mills	19	658,940	18,230			34	677,223
Brass mills	72,777	45,033	72,559	163,982	123,656	119	478,126
Chemical plants	19		72			1,485	1,576
Secondary smelters	3,127		1,011	250	65	10	4,463
Foundries and miscellaneous	2,595	183	14,628	80	26	4,296	21,808
Total	78,537	704,156	106,500	164,312	123,747	5,944	1,183,196

STOCKS

Over-all industry stocks rose in 1949 against the trend since the end of 1945. The following table gives domestic stocks of copper as reported by primary smelting and refining plants. Stocks of blister and anode copper in transit from smelters to refineries are included with blister copper.

Stocks of copper at primary smelting and refining plants in the United States at end of year, 1945–49, in short tons

Year	Refined copper	Blister and materials in process of refining [1]	Year	Refined copper	Blister and materials in process of refining [1]
1945	130,000	331,000	1948	67,000	182,000
1946	95,000	254,000	1949	61,000	262,000
1947	60,000	212,000			

[1] Includes copper in transit from smelters in the United States to refineries therein.

Producers' (smelters and refineries) inventories of crude and refined copper at the end of 1949 were 29 percent above those in 1948 and exceeded 1947 by 18 percent. Only 19 percent of the 1949 total was in the form of refined copper, the remainder being in smelter shapes at smelters in transit to refineries, and blister and materials in process of refining at refineries.

Dissipation of stocks of copper in the hands of the Office of Metals Reserve was completed in 1948, either by disposal to industry or by absorption into the National Stockpile.

Fabricators' stocks of refined metal (including in-process copper and primary fabricated shapes), according to the United States Copper Association, were 354,992 tons at the end of 1949, or 6 percent less than at the beginning of the year, marking a continuation of the drop from the 423,432 tons at the end of 1947. Working stocks were 285,298 tons, or close to the tonnages so designated for the previous 3 years. After accounting for unfilled sales of metal, the deficiencies of stocks in relation to unfilled orders fell 114,140 tons to 36,920 tons at the end of 1949. The latter tonnage marked the smallest deficiency in the period during which stocks have been inadequate to fill orders, beginning in 1941; at the end of 1941 stocks failed by 304,675 tons to cover booked orders.

Figures compiled by the Copper Institute show that domestic stocks of refined copper increased from 96,080 tons at the end of 1948 to 116,027 tons at the end of 1949. Inventory data of the Bureau of Mines and the Copper Institute always vary owing to somewhat different bases. Before 1947, a primary reason was that the Copper Institute coverage was limited to duty-free copper. The inclusion by the Copper Institute of all copper after January 1, 1947, reduced the differences chiefly to variations in individual interpretation. In the Bureau of Mines classification, cathodes to be used chiefly for melting and casting into shapes are considered stocks in process and not refined stocks.

Stocks of copper in fabricators' hands at end of year, 1945–49, in short tons

	Stocks of refined copper [1]	Unfilled purchases of refined copper from producers	Working stocks	Unfilled sales to customers	Excess stocks over orders booked
1945	375,618	44,100	268,490	362,436	−211,208
1946	411,013	59,421	286,418	526,648	−342,632
1947	423,432	103,765	293,859	338,260	−104,922
1948	379,346	81,496	295,958	315,944	−151,060
1949	354,992	82,793	285,298	189,407	−36,920

[1] Includes in-process metal and primary fabricated shapes. Also includes small quantities of refined copper held at refineries for fabricators' account.

PRICES

Reports to the Bureau of Mines from copper-selling agencies indicate that 1,129,000 short tons of copper were delivered to domestic and foreign purchasers in 1949 at an average price (f. o. b. refinery) of 19.7 cents a pound—a drop of 9 percent from the 21.7 cents in 1948 but 43 percent above the annual average for 1942–47. The averages for 1942–47 exclude bonuses paid for overquota outputs of individual

mines, which were first applicable to February 1942 tonnages; the Premium Price Plan ended June 30, 1947. The history of the Premium Price Plan is given briefly in Minerals Yearbook, 1947 (pp. 466–468), and at greater length in Bureau of Mines Information Circular 7536.

Average monthly quoted prices of electrolytic copper for domestic and export shipments, f. o. b. refineries, in the United States, 1948–49, in cents per pound

Month	Domestic f. o. b. refinery [1]	Domestic f. o. b. refinery [2]	Export f. o. b. refinery [2]	Domestic f. o. b. refinery [1]	Domestic f. o. b. refinery [2]	Export f. o. b. refinery [2]
January	21.37	21.200	21.532	23.37	23.200	23.430
February	21.37	21.200	21.507	23.37	23.200	23.432
March	21.37	21.200	21.531	23.36	23.178	23.425
April	21.37	21.200	21.534	21.66	21.450	21.602
May	21.37	21.200	21.554	17.92	17.763	18.019
June	21.37	21.200	21.696	16.48	16.342	16.543
July	21.49	21.375	21.668	17.01	17.059	17.140
August	23.11	23.065	23.425	17.50	17.325	17.551
September	23.37	23.200	23.425	17.50	17.325	17.550
October	23.37	23.200	23.425	17.50	17.325	17.550
November	23.37	23.200	23.425	18.30	18.062	18.290
December	23.37	23.200	23.454	18.37	18.200	18.425
Average for year	22.20	22.038	22.348	19.36	19.202	19.421

[1] As reported by American Metal Market.
[2] As reported by E &MJ Metal and Mineral Markets.

Average yearly quoted prices of electrolytic copper for domestic and export shipments, f. o. b. refineries, in the United States, 1940–49, in cents per pound

	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
Domestic f. o. b. refinery [1]	11.40	11.87	11.87	11.87	11.87	11.87	13.92	21.15	22.20	19.36
Domestic f. o. b. refinery [2]	11.296	11.797	11.775	11.775	11.775	11.775	13.820	20.958	22.038	19.202
Export f. o. b. refinery [2]	10.770	10.901	11.684	11.700	11.700	11.700	14.791	21.624	22.348	19.421

[1] As reported by American Metal Market.
[2] As reported by E&MJ Metal and Mineral Markets.

The average quoted price for electrolytic copper, f. o. b. refinery, was 23.2 cents a pound at the beginning of the year. Demand collapsed at the end of the first quarter, following the beginning of the general industrial reaction at the time; the price dropped to 22.95 at the end of March, lagging behind initial declines for lead and zinc. Subsequent falls carried the copper price to 15.7 cents on June 17. An upward movement began with the rise to 16.525 cents on July 6; as a result of additional gains the price was 18.2 cents in early November and remained there beyond the end of the year. The average price for the year—19.202 cents—was 13 percent less than that in 1948—22.038 cents. The average quoted price for export copper, f. o. b. refinery, was 19.421 cents in 1949 and 22.348 in 1948. The export price ranged from 0.081 cent a pound higher than the domestic price in July to 0.256 in May and averaged 0.219 for the year compared with 0.310 in 1948.

London Price.—The official price of the British Ministry of Supply for electrolytic copper, delivered buyers' plants, was £140 per long ton (25.2 cents a pound) from October 1, 1948, through May 15, 1949.

On May 16 the price began a descent during which it reached £104 on July 12; on July 13 it rebounded to £107 10s. On September 22, after devaluation of the pound sterling, the price was returned to £140 a ton (then equivalent to only 17.5 cents a pound) and on November 4 rose to £153 (19.1 cents a pound). Statutory maximum prices for copper, lead, and zinc were revoked as of November 15, 1949.

FOREIGN TRADE [2]

Before World War II the United States produced more copper than domestic industry could utilize and consequently, had a surplus available for exportation. United States smelting and refining plants, moreover, had capacity that exceeded domestic production, and this excess capacity was used to smelt and refine imported copper under bond for reexportation in refined or in manufactured forms. The excise tax placed on copper June 21, 1932, was effective chiefly in preventing foreign copper from invading domestic consumption channels. Copper smelted, refined, and fabricated under bond was not subject to the 4-cent tax. The exportable surplus no longer held when the war program called for all copper available from domestic and foreign sources and when, despite the addition of foreign supplies, the filling of most civilian requirements had to be postponed. The Government became the importing agent in the war, and the excise tax thus was ineffective. In the postwar period, demand continued far above the prewar level as postponed civilian demands were filled and the general industrial level continued high. The Government discontinued importing copper at the war's end. To encourage imports so that expanded peacetime demand could be filled the excise tax was suspended, effective April 30, 1947–June 30, 1950. Early in 1949 the tariff concession on copper, contained in the General Agreement on Tariffs and Trade (Geneva conference, October 1947), became effective under suspension. This concession reduced the excise tax to 2 cents. If the tax suspension terminates on June 30, 1950, as provided by legislation in effect in 1949, the tax when reimposed will be 2 instead of 4 cents a pound, as before the war.

IMPORTS

Total imports of unmanufactured copper rose 9 percent in 1949 and established a new peacetime record for the second successive year. Entries of refined copper, the most important class, gained 11 percent and of concentrates 34 percent, whereas the unrefined class (second in importance) dropped 2 percent; the other classes are relatively small. The increase in refined imports came largely from Canada and Peru because Chile, the chief source of this type, failed by nearly 20,000 tons to equal its record for 1948. Receipts of concentrates rose chiefly because of larger entries from Canada, Chile, Cyprus, the Union of South Africa, and Mexico. Much smaller receipts of unrefined copper from Chile and Peru slightly more than offset the larger quantities from Yugoslavia, Northern Rhodesia, and Mexico and the new imports from Turkey, resulting in the small decline noted.

[2] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Copper (unmanufactured) imported into the United States, 1940–44 (average) and 1945–49 [1]

[U. S. Department of Commerce]

Year	Short tons	Year	Short tons
1940–44 (average)	608,617	1947	[2] 413,890
1945	853,196	1948	[2] 507,449
1946	[2] 396,335	1949	552,704

[1] Data include copper imported for immediate consumption plus material entering country under bond.
[2] Revised figure.

Copper (unmanufactured) imported into the United States, 1945–49,[1] in short tons [2]

[U. S. Department of Commerce]

	Ore (copper content)	Concentrates (copper content)	Regulus, black or coarse copper and cement (copper content)	Unrefined black blister and converter copper in pigs or converter bars	Refined in ingots, plates, or bars	Old and scrap copper, fit only for remanufacture; and scale and clippings
1945	8,858	48,632	19,862	243,101	531,367	1,376
1946	[3] 4,895	[3] 41,844	732	[3] 193,387	154,371	1,106
1947	14,665	71,193	5,223	167,378	[3] 149,478	5,953
1948						
Australia	2	767				801
Bolivia	804	5,925				
Brazil						1,137
Canada	34	20,726	813	120	17,127	4,749
Newfoundland-Labrador		3,665				33
Chile	5,052	14,480	341	70,542	230,288	
Cuba	41	[3] 16,213				16
Ecuador		482				
Malta, Gozo, and Cyprus		2,680				
Mexico	1,011	7,462	1,485	46,651	947	37
Netherlands				552		239
Northern Rhodesia [4]		131	14	18,916		
Peru	431	4,582	638	13,434	233	
Philippines	([5])	[3] [5] 2,252				
Union of South Africa	794	1,636	32	3,321		143
Yugoslavia				2,298		
Other countries	28	291	334	2	529	2,179
Total	8,197	[3] 81,301	3,657	155,836	249,124	9,334
1949						
Australia	650	289				2
Bolivia	992	3,675	4			
Canada	283	27,271	518	29	47,930	2,794
Newfoundland-Labrador		3,934				62
Chile	3,695	19,104	199	51,770	210,443	175
Cuba	86	15,514				244
Ecuador	8	745	50			
Japan					1,112	55
Malta, Gozo, and Cyprus		6,888				
Mexico	271	11,167	739	51,053	1,466	8
Northern Rhodesia [4]		108	1	27,122		13
Peru	460	6,248	538	309	14,756	5
Philippines	([5])	[5] 7,916				59
Turkey				4,572		
Union of South Africa	294	5,748	7	2,771		99
Yugoslavia				14,727		
Other countries	79	213	19	23	102	3,285
Total	6,818	106,814	2,084	152,376	275,811	6,801

[1] Changes for table in Minerals Yearbook, 1947, p. 470, are as follows for 1946: Ore imported from Chile, 1,346 tons; Mexico, 3,384 tons; other countries, 163 tons; total, 4,895 tons. Concentrates, Chile, 2,962 tons; Canada, 9,366 tons; other countries, 118 tons; total, 41,844 tons. Unrefined, Mexico, 56,024 tons; total, 193,387 tons.
[2] Data include copper imported for immediate consumption plus material entering the country under bond.
[3] Revised figure.
[4] Tonnages credited to Southern Rhodesia by the U. S. Department of Commerce have been added to Northern Rhodesia.
[5] Some copper in "ore" and "other" from Republic of the Philippines is not separately classified and is included with "concentrates."

EXPORTS

Most of the copper exported from the United States is in advanced forms of manufacture, in which the copper content is not determined, and in the form of refined copper. Shipments in refined form dropped 3 percent in 1949. Thirteen countries received quantities exceeding 1,400 tons, the United Kingdom being the destination of 26,236 tons, France 23,948, India 20,514, Italy 19,914, the Netherlands 11,611, Germany 10,600, and Switzerland 9,374 tons. The quantity exported to the United Kingdom was sharply contracted from 1948, whereas all other countries mentioned, except Switzerland, had noteworthy gains that, however, were insufficient to counterbalance the drop in shipments to the United Kingdom.

Of the other classes exported, rods rose 56 percent and old and scrap advanced to several times the small quantity in 1948. All other classes covered by the accompanying table declined in 1949.

Copper exported from the United States, 1940–44 (average) and 1945–49

[U. S. Department of Commerce]

Year	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined copper and manufactures	Total (except "Other copper manufactures")		Other copper manufactures [1]	Grand total
	Short tons			Value		
1940–44 (average)	994	265,815	266,809	$88,551,027	$1,763,552	$90,314,579
1945	34	132,555	132,589	54,212,247	1,000,008	55,212,255
1946	23	97,475	97,498	37,114,211	1,472,662	38,586,873
1947	115	196,999	197,114	99,907,924	2,580,974	102,488,898
1948	2,473	[2] 207,022	[2] 209,495	[2] 111,313,040	2,249,857	[2] 113,562,897
1949	200	195,990	196,190	95,343,450	1,655,349	96,998,799

[1] Weight not recorded.
[2] Revised figure.

Copper exported from the United States, 1945–49,[1] in short tons

[U. S. Department of Commerce]

	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined in bars, ingots or other forms	Rods	Old and scrap	Pipes and tubes	Plates and sheets	Wire and cable, bare	Wire and cable, insulated	Other copper manufactures
1945	34	48,563	5,009	133	4,197	3,797	11,464	59,392	(2)
1946	23	52,629	2,452	909	2,131	3,687	4,499	30,368	(2)
1947	115	147,642	2,416	969	5,107	4,374	11,197	25,204	(2)
1948	2,473	142,598	8,101	2,266	5,246	2,853	10,694	[3] 35,264	(2)
1949									
Algeria		1,727			(4)			(4)	
Argentina		1,871			78	1	2	244	
Austria		2,481		643	4	19	86	676	
Belgium-Luxembourg		1,404	(4)	28	41	3	11	115	
Brazil		3,198	8		354	62	21	340	
Canada	8	50	190	354	303	96	1,286	2,193	
Colombia		40	1		212	128	121	1,589	
Cuba	4	5	23		670	120	321	1,264	
Denmark		831	4,026		2		280	368	
France		23,948	2	168	5	1	42	1,296	
Germany	118	10,600		2,896		1		28	
Greece		241			22	1	9	426	
India	1	20,514	1	2,209	94	25	14	251	(2)
Indonesia		71	6		33	5	39	1,315	
Italy		19,914	403	1,417	35	6	898	245	
Mexico	1	6	75	54	373	115	241	1,033	
Netherlands		11,611	7,634		155	8	104	162	
Norway		495	4		63	14	45	14	
Philippines			3	(4)	85	26	146	2,117	
Saudi Arabia			3		13	4	267	847	
Switzerland		9,374	168		39		1	10	
Turkey			72		4	15	10	1,919	
Union of South Africa		3	2		46	6	1,542	316	
United Kingdom	68	26,236	1		7	30	1	14	
Venezuela		1	4		222	79	1,104	2,604	
Other countries		3,206	52	515	484	323	1,288	5,502	
Total:									
Short tons	200	137,827	12,678	8,284	3,344	1,088	7,881	24,888	(2)
Value	$79,279	$57,324,108	$5,574,184	$2,975,831	$3,060,857	$857,096	$4,234,481	$21,228,614	$1,655,349

[1] Changes in table in Minerals Yearbook, 1948, p. 494, are as follows: Insulated wire and cable, other countries 5,701 tons; total, 35,264 tons, $28,979,164.
[2] Weight not recorded. [3] Revised figure. [4] Less than 1 ton.

Unmanufactured brass (ingots, bars, rods, shapes, plates, and sheets) exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1945 [1]	33,810	$11,850,242	1948 [1]	6,395	$4,499,160
1946 [1]	9,030	3,879,189	1949	4,287	3,080,509
1947 [1]	12,622	7,640,678			

[1] Revised figure.

Brass and bronze exported from the United States, 1948–49,[1] by classes

[U. S. Department of Commerce]

Class	1948		1949	
	Short tons	Value	Short tons	Value
Ingots	424	$191,240	794	$347,903
Scrap and old	6,584	2,247,385	13,963	4,673,525
Bars, rods, and shapes	[2] 2,040	[2] 1,341,389	1,563	1,044,606
Plates and sheets	3,931	2,966,531	1,930	1,688,000
Pipes and tubes	2,484	2,303,487	1,574	1,522,619
Pipe fittings	595	1,031,969	696	1,053,459
Plumbers' brass goods	1,594	3,384,099	1,571	3,138,067
Wire of brass or bronze	2,455	2,638,524	1,447	1,596,073
Hardware of brass or bronze	(3)	1,145,682	(3)	980,803
Other brass or bronze manufactures	(3)	[2] 5,191,327	(3)	4,518,492
Total	(3)	[2] 22,441,633	(3)	20,563,547

[1] Changes (1947) for table in Minerals Yearbook, 1947, p. 472, and Minerals Yearbook, 1948, p. 495, are as follows: Pipes and tubes, $2,366,903; total, $27,822,660.
[2] Revised figure.
[3] Weight not recorded.

Copper sulfate (blue vitriol) exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1945	34,967	$3,419,332	1948	42,135	$6,514,968
1946	41,345	4,076,850	1949	31,717	4,320,726
1947	34,021	4,099,551			

WORLD REVIEW

In the leading copper-producing countries of the world in 1949, output expanded in Northern Rhodesia and Canada and dropped in the United States, Chile, and the Belgian Congo. The decreases approximately counterbalanced the gains, and the world total differed little in 1949 from that in 1948. The indications are that output in the U. S. S. R. rose in 1949, but data for this country continue unsatisfactory.

World mine production of copper, 1943–49, in metric tons

[Compiled by Berenice B. Mitchell]

Country	1943	1944	1945	1946	1947	1948	1949
North America:							
Canada	260,900	248,145	215,416	166,892	204,897	218,387	239,149
Newfoundland	5,669	5,021	4,693	4,458	3,853	4,126	
Cuba	6,405	6,584	9,067	11,323	13,729	16,300	17,400
Mexico	49,774	41,302	61,680	61,054	64,811	59,076	57,246
United States	989,568	882,277	701,154	552,234	768,892	757,326	682,880
Total North America	1,312,316	1,183,329	992,010	795,961	1,056,182	1,055,215	996,675
South America:							
Bolivia [1]	6,011	6,170	6,097	6,127	6,241	6,616	5,074
Chile	497,141	498,520	470,181	365,034	426,671	448,289	367,036
Ecuador [2]	4,418	3,720	3,289	2,699	120	482	676
Peru	33,407	32,396	31,916	24,592	22,492	18,068	28,373
Total South America	540,977	540,806	511,483	398,452	455,524	473,455	401,159
Europe:							
Austria	1,365	1,500	320	125	259	982	1,296
Finland	16,363	15,841	14,978	13,550	15,409	18,384	18,741
France	149	82	327	333	386	(3)	(3)
Germany [4]:							
Federal Republic	21,600	23,500	(3)	[5] 18,300	[5] 17,500	[6] 364	[6] 873
Soviet Zone						(3)	(3)
Hungary	910	[7] 750	(3)	160	[4] 300	(3)	(3)
Italy [8]	[7] 2,540	363	2,177	104	95	90	30
Norway	16,248	14,462	5,203	12,249	14,707	15,112	4,600
Spain [8]	11,100	11,000	8,300	8,600	[9] 6,454	[9] 5,503	[9] 6,702
Sweden	17,832	16,121	14,926	15,362	13,144	14,835	16,273
U. S. S. R. [4,10,11]	130,000	135,000	140,000	150,000	165,000	180,000	200,000
Yugoslavia [11]	27,000	22,700	12,500	32,250	40,500	52,500	34,000
Total Europe [4,10]	245,000	241,500	205,000	251,000	274,000	303,000	298,000
Asia:							
China [11,12]	1,146	1,030	623	947	915	472	(3)
Formosa	6,020	3,985	(3)	(3)	(3)	1,183	(3)
Cyprus [1]	5,177	1,422	----	71	12,681	15,735	23,936
India	6,909	6,706	6,230	6,060	5,462	6,316	6,305
Indonesia	60	60	(3)	(3)	(3)	(3)	----
Japan	[13] 94,729	[13] 86,842	27,984	17,173	21,892	25,765	32,741
Korea (South)	2,052	2,720	1,251	522	389	66	28
Philippines	(3)	(3)	(3)	----	2,502	3,350	7,007
Turkey	10,000	[11] 11,050	[11] 9,858	[11] 10,050	[11] 10,080	12,367	12,130
U. S. S. R.	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Total Asia [4,10,14]	135,000	116,000	48,000	37,000	56,000	67,000	85,000
Africa:							
Algeria	5	44	76	----	----	----	----
Belgian Congo [11]	156,850	165,464	160,200	143,885	150,840	155,481	141,399
French Morocco	227	635	43	80	67	449	360
Northern Rhodesia	258,410	225,685	199,337	191,546	197,288	236,472	259,064
Portuguese West Africa	224	71	52	88	28	394	[illegible]
Southern Rhodesia	20	5	10	10	10	(3)	(3)
South-West Africa [4]	5,000	(3)	----	----	3,100	8,270	[illegible]
Union of South Africa	22,731	22,869	24,616	26,980	[illegible]	[illegible]	30,159
Total Africa	443,467	414,783	383,734	362,560	380,663	430,516	441,454
Australia	24,716	28,506	24,914	18,040	13,334	12,567	12,500
World total [4,14]	2,701,000	2,525,000	2,165,000	1,863,000	2,236,000	2,332,000	2,235,000

[1] Copper content of exports.
[2] United States imports.
[3] Data not available; estimate by authors of chapter included in total.
[4] Approximate production.
[5] British and Russian zones only.
[6] American and British zones only.
[7] January to June, inclusive.
[8] According to Yearbook of American Bureau of Metal Statistics.
[9] Starting in 1947 does not include content of pyrites shipped to foreign countries, the content of which may or may not be recovered.
[10] Output from U. S. S. R. in Asia included with U. S. S. R. in Europe.
[11] Smelter production.
[12] Data represent areas designated as Free China during the period of Japanese occupation.
[13] Preliminary data for fiscal year ended March 31 of year following that stated.
[14] Includes estimates for Burma.

World smelter production of copper, 1943–49, in metric tons

[Compiled by Berenice B. Mitchell]

Country	1943	1944	1945	1946	1947	1948	1949
North America:							
Canada	[1] 232,740	[1] 224,049	[1] 198,427	[1] 151,434	179,997	200,736	206,394
Mexico	43,013	32,974	53,287	52,371	58,475	48,761	49,359
United States [2]	1,103,918	1,022,382	784,173	592,229	857,007	839,550	779,842
Total North America	1,379,671	1,279,405	1,035,887	796,034	1,095,479	1,089,047	1,035,595
South America:							
Chile	488,518	489,906	462,080	358,963	408,400	424,881	351,314
Ecuador [3]	4,030	3,708	3,285	2,659	---	---	---
Peru	28,215	26,888	25,550	19,595	17,824	11,824	21,138
Total South America	520,763	520,502	490,915	381,217	426,224	436,705	372,452
Europe:							
Austria	5,711	6,051	1,454	---	378	2,143	3,761
Belgium [4]	18,320	4,310	---	---	---	---	(5)
Finland	15,535	6,756	13,686	20,952	21,087	20,672	18,224
France [6]	82	20	25	2	318	(5)	(5)
Germany:	[7] 31,300	[7] 24,000	(5)	[8] 38,809			
Federal Republic					[8, 9] 32,016	[8, 9] 62,244	[8] 145,563
Soviet Zone					(5)	(5)	(5)
Italy	1,172	231	2,181	7	105	167	30
Norway	2,014	937	1,692	7,549	7,920	8,935	9,044
Rumania	70	(5)	(5)	1,116	(5)	(5)	(5)
Spain	10,952	10,891	6,268	9,917	17,287	18,640	9,016
Sweden	15,938	15,062	18,249	14,471	14,258	17,180	14,359
U. S. S. R. [7, 10]	130,000	135,000	140,000	150,000	165,000	180,000	200,000
Yugoslavia [7]	27,000	22,700	12,500	32,250	40,500	52,500	34,000
Total Europe [7, 10]	258,000	226,000	215,000	275,000	314,000	378,000	450,000
Asia:							
China	[11] 1,146	[11] 1,030	623	947	915	472	(5)
India	6,198	5,822	6,096	6,412	6,426	5,957	6,721
Japan	[12] 119,858	[12] 102,352	45,737	23,043	36,812	54,330	74,037
Korea:	4,554	5,193					
North Korea			(5)	(5)	(5)	(5)	(5)
South Korea			427	527	392	514	808
Turkey	9,730	11,050	9,858	10,050	10,080	10,979	11,283
Total Asia [7, 10]	141,500	125,500	68,000	46,000	60,000	77,252	100,000
Africa:							
Belgian Congo	156,850	165,484	160,200	143,885	150,840	155,481	141,399
Northern Rhodesia	255,027	224,397	197,192	185,607	195,610	217,044	263,491
Union of South Africa	22,150	22,397	23,665	26,723	29,026	28,993	29,717
Total Africa	434,027	412,278	381,057	356,215	375,476	401,518	434,607
Australia	20,785	20,217	20,827	23,023	19,818	11,572	10,192
World total [7]	2,756,000	2,584,000	2,212,000	1,878,000	2,291,000	2,394,000	2,403,000

[1] Copper content of blister produced.
[2] Smelter output from domestic and foreign ores, exclusive of scrap. Production from domestic ores only, exclusive of scrap, was as follows: 1943, 891,492; 1944, 910,245; 1945, 710,073; 1946, 543,996; 1947, 782,780 1948, 764,278; 1949, 687,580. The diversion during the war of Belgian Congo matte from its previous destination, Belgium, for resmelting in the United States resulted in some duplication. The movement ended in 1945.
[3] United States imports.
[4] Figures represent blister copper only. Belgium reports a large output of refined copper which is not included above as it is believed produced principally from crude copper from Belgian Congo and would therefore duplicate output reported under the latter country.
[5] Data not available; estimate by authors of chapter included in total.
[6] Exclusive of material from scrap.
[7] Approximate production.
[8] Includes scrap.
[9] American and British zones only.
[10] Output from U. S. S. R. in Asia included with U. S. S. R. in Europe.
[11] Data represent areas designated as Free China during the period of Japanese occupation.
[12] Preliminary data for fiscal year ended March 31 of year following that stated.

Belgian Congo.—The drop in output in Belgian Congo is explained chiefly by the unusually small precipitation during the rainy season, leading to inadequate water supplies for the Francqui power plant at Cornet Falls. The reserve steam plants at Jadotville and Lubum-

bashi were placed in service; but insufficient coal deliveries, impeded by inadequate transportation facilities, made it impossible to operate the reserve plants at full capacity. Power shortages, it is believed, will end permanently when the new Bia power plant is started and attains full operation, expected to take place in early 1950. The mines being worked by the Union Minière du Haut Katanga, chief of which were Kipushi (Prince Leopold), Musonoie, Kolwezi, Luishia, Kamoto, and Kalabi, produced ore containing copper principally. Expansion of the Kolwezi and Kipushi concentrators and of the Jadotville-Shituru electrolytic plant proceeded during the year. An exhaustive description of the Lubumbashi smelter was made available in 1949.[3]

Exports of Belgian Congo copper leave through the ports of Matadi, Belgian Congo; Lobito, Angola; and Beira, Mozambique. Exports, by kinds and destinations, in the first 9 months of 1949 were as follows: [4]

	Metric tons
Shituru cathodes:	
Belgium	220
Lobito depot	388
Total	608
Wire bars (99 percent):	
Beira depot	21,754
Belgium	18,061
Denmark	508
France	2,030
Italy	2,700
Sweden	5,271
Union of South Africa	2,827
Total	53,151
Ingot bars (99 percent):	
Beira depot	1,552
Angola	21
France	508
Lobito depot	21
Total	2,102
Ingots, ordinary and UMPC (97 percent):	
Angola	35
Beira depot	7,949
Belgium	29,212
Lobito depot	20,954
Total	58,150
Total: January–September 1949	114,011
January–September 1948	118,091

Quantities shown as Lobito and Beira depots and as Angola are for transshipment, as those credited to the Union of South Africa are believed to be. Figures on final destinations of consignments of

[3] Murdock, Thos. G., The Lubumbashi Smelter of the Union Minière du Haut Katanga: Consular Rept. 26, Elisabethville, Belgian Congo, Dec. 21, 1949, 36 pp.

[4] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 1, January 1950, pp. 8 and 9.

copper from the Beira and Lobito depots for the the first half of 1949 were as follows:

	Beira depot	Lobito depot
Ingots, ordinary and UMPC:		
Exports:		
Belgium	3, 334	12, 247
Shipments to depot	4, 078	11, 951
Wire bars:		
Exports:		
Australia	4, 268	---------
France	1, 524	---------
India	1, 372	---------
Italy	9, 444	---------
Union of South Africa	1, 872	---------
Total wire-bar exports	18, 480	---------
Shipments to depot	14, 834	---------
Electrolytic slimes:		
Exports:		
Belgium	--------	15
Shipments to depot	--------	15

According to another report by Murdock, a published report on ore reserves placed copper (metal) reserves in the Congo at more than 10,000,000 tons at the end of 1945. He stated also that Professor Robert, in his 1946 edition of Le Congo physique, placed reserves at 9 to 12,000,000 tons of copper in ore averaging 6 percent.

Canada.—Both mine and refinery production of copper rose in 1949, marking extensions of the annual gains since the recent low levels of 1946. Mine output was the largest since 1944 and refinery output the greatest since 1945.

Copper produced (mine output) in Canada, 1945–49, by Provinces, in short tons

Province	1945	1946	1947	1948	1949 (preliminary)
British Columbia	12, 876	8, 750	20, 900	21, 502	27, 377
Manitoba	20, 563	19, 251	15, 316	18, 960	17, 351
Newfoundland (not Canadian 1945–48)	--------	--------	--------	--------	3, 479
Ontario	119, 726	89, 712	113, 934	120, 383	112, 096
Quebec	51, 342	34, 999	42, 561	48, 813	68, 421
Saskatchewan	32, 950	31, 356	33, 151	31, 074	34, 894
Total	237, 457	183, 968	225, 862	240, 732	263, 618

Ontario fell from its customary place as supplier of more than half of Canada's copper from the nickel–copper ores of the Sudbury district; it produced 43 percent of the 1949 total. The inclusion of Newfoundland's output in Canadian figures for the first time in 1949 did not change Ontario's percentage share. The International Nickel Co. of Canada, Ltd., is by far the largest copper producer in Canada. Production of copper, nonetheless, is determined in large part by conditions in the nickel market, because the latter metal is the principal value in the ore. Reserves proved during the year exceeded the tonnage mined and were 251,805,000 short tons at the end of 1949 compared with 246,177,000 tons at the beginning of the year. The combined nickel–copper content was 7,630,000 and 7,503,000 tons, respectively. In 1949, 9,984,891 tons of ore were mined compared with 10,866,862 in 1948 and 10,406,644 in 1947. The company sold 110,538 tons of copper in 1949 compared with 109,565 in 1948. In the same periods sales of nickel in all forms

aggregated 104,646 and 120,049 tons, respectively. The company is attempting to prepare the underground mines for greater production to compensate for the approaching completion of work at the low-grade Frood-Stobie open pits. A new concentrator is under construction at the mine site of the Creighton mine and is scheduled for completion by 1951. The concentrator will have a capacity of 6,000 tons a day and will supply the concentrate by pipeline to Copper Cliff, approximately 7½ miles. The Falconbridge Nickel Mines, Ltd. —the other important producer in Ontario—hoisted 921,916 tons at the Falconbridge mine in 1949 compared with 821,284 in 1948. Development ore at the McKim mine was 15,896 tons compared with none. Mine, smelter, and refinery outputs were at new peaks; inventories of matte and refined copper increased. Developed ore reserves at the Falconbridge and McKim mines aggregated 8,592,000 tons, averaging 1.62 percent nickel and 0.85 percent copper, and indicated reserves in outside holdings totaled 6,199,000 tons averaging 1.86 and 1.01 percent, respectively.

Quebec is ordinarily Canada's second-largest copper-producing Province; it supplied most of Canada's increase in 1949. Noranda Mines, Ltd., is an outstanding producer. A total of 1,257,202 tons of ore was hoisted at the Horne mine; 794,152 tons were milled and 601,851 tons of ore and concentrates smelted. The smelter also treated 454,929 tons of custom material. Copper output for the Horne mine was 25,948 tons out of a total smelter output of 68,502 tons of new copper. In addition, the Horne mine produced 185,418 ounces of gold and 524,315 ounces of silver. Developed ore reserves above the 2,975-foot level were 17,507,000 tons, averaging 2.24 percent copper and 0.187 ounce of gold per ton, of which 4,290,000 tons averaged 7.13 percent and 0.161 ounce, and 13,217,000 tons averaged 0.66 percent and 0.196 ounce. Production was begun at the newly developed East Sullivan mine at the close of 1948 and was a factor in the larger copper output of Quebec in 1949. The copper is custom-reduced by Noranda. The property of the Quemont Mining Corp., Ltd., which adjoins the Horne mine and in which Noranda has a substantial interest, began to produce in 1949; the mill was started on June 20. Metals contained in shipments were 5,643 tons of copper, 42,081 ounces of gold, 155,973 ounces of silver, and 198 tons of zinc. All copper-concentrate and cyanide-plant base bullion were delivered to the Noranda smelter. In an address to stockholders in April 1949, the president said that the company had an agreement which permitted sale of 90 percent of its refined copper to the United States stockpile until March 31, 1953, on a satisfactory pricing basis. Ore reserves at the end of 1949 were reported as 9,229,500 tons, averaging 1.50 percent copper, 0.17 ounce of gold and 0.95 ounce of silver to the ton, and 2.78 percent zinc. A total of 292,235 tons of ore, containing 2.92 percent copper, 7.50 percent zinc, and 0.031 ounce of gold and 2.61 ounces of silver per ton, was milled by the Normetal Mining Corp., Ltd. Recoverable metals totaled 7,586 tons of copper, 4,725 ounces of gold, 434,199 ounces of silver, and 17,696 tons of zinc. Copper concentrate is smelted at Noranda and zinc concentrate shipped to the United States. Estimated reserves were 1,452,800 tons, containing 3.53 percent copper and 7.71 percent zinc. Ore milled by the Waite Amulet Mines, Ltd. (controlled by

Noranda), at the Waite and Amulet Dufault mines totaled 453,174 tons, from which were recovered 16,749 tons of copper, 20,821 tons of zinc, 8,857 ounces of gold, and 426,666 ounces of silver. The development of additional tonnages of ore and higher metal prices prevented anticipated exhaustion of shafts "F" and "C" of the Waite mine. Mining of a new lower-grade "C" ore body will begin in the summer of 1950. Disclosure by diamond drilling of a massive sulfide ore body 3,000 feet east of the old Waite mine led to sinking of a shaft, the "East Waite." A year will be required to complete the necessary work to determine the size and grade of the new ore body. Ore reserves at Waite were 48,000 tons and at Amulet Dufault 1,022,972 tons of ore averaging 5.57 percent copper and 4.02 percent zinc and 79,212 tons averaging 1.8 percent copper and 6.5 percent zinc. The Canadian Copper Refiners, Ltd. (controlled by Noranda), produced 111,100 tons of refined copper in 1949 compared with 95,400 tons in 1948. Approximately 1 million dollars was spent, chiefly in connection with the production of vertically cast copper cake and billets.

Copper produced in Saskatchewan and Manitoba comes almost entirely from the Flin Flon mine of the Hudson Bay Mining & Smelting Co., Ltd., and the Sherridon operation of Sherritt Gordon Mines, Ltd. At the Hudson Bay mine 1,885,107 tons were mined, of which 1,853,476 tons were milled and the remainder was direct-smelting ore. The copper smelter treated 359,026 tons of Hudson Bay concentrates and ores and 60,958 tons of custom concentrates. Company material shipped to the refinery contained 42,633 tons of copper, 121,286 ounces of gold, 1,868,507 ounces of silver, and 143,615 pounds of selenium.[5] Estimated ore reserves, as of January 1, 1950, were 20,157,000 tons, averaging 2.04 percent copper, 4.34 percent zinc, and 0.084 ounce of gold and 1.14 ounces of silver per ton. At Sherridon 432,524 tons of ore were mined and milled, and 9,480 tons of copper, 5,247 ounces of gold, 172,317 ounces of silver, and 10,128 tons of zinc concentrate produced—only slightly below the performance in 1948. Year-end reserves were 396,400 tons, averaging 2.44 percent copper, 1.88 percent zinc, and 0.019 ounce of gold, and 0.58 ounce of silver per ton. No new reserves were developed; but the mining of some marginal ore, permitted by high metal prices, caused reserves to be reduced less than the quantity mined. Life of the mine may extend into early 1951. At Lynn Lake, mine-development and pilot-plant operations were pushed. Continuation of the 1949 program in 1950 is contemplated, with the prospect that the foundations for the permanent plant at the "El" shaft will be prepared. The economics of moving the town of Sherridon to Lynn Lake will be investigated. An additional 2,000,000 tons of ore were proved in 1949, and reserves at the end of the year were 10,365,000 tons, averaging 1.443 percent nickel and 0.681 percent copper and 153,000 tons containing 1.113 percent copper, 2.491 percent zinc, and 0.016 ounce of gold per ton.

Chief producers in British Columbia are the Granby Consolidated Mining, Smelting & Power Co., Ltd., and the Britannia Mining & Smelting Co., Ltd. Granby celebrated 50 years of mining in 1949; aggregate recovery of copper in the 50 years was 685,030 tons from 58,860,783 tons of ore.

[5] Selenium reported as contained in material shipped in 1948, Minerals Yearbook, 1948, p. 459, was erroneously stated as 138,507 ounces instead of pounds.

Exports of ingots, bars, and billets from Canada in 1949 as compared with 1948 were as follows, by countries of destination, in short tons:

Destination:	1948	1949
United Kingdom	63, 493	59, 491
United States	18, 085	50, 212
France	14, 098	7, 403
India	2, 936	5, 741
Switzerland	4, 120	1, 847
Brazil	--------	790
Netherlands	2, 497	756
Czechoslovakia	6, 411	392
Poland	2, 295	--------
Other countries	2, 234	528
Total	116, 169	127, 160

Exports of copper in ore totaled 37,057 tons, of which 29,650 went to the United States, 6,495 to Norway, 800 to the United Kingdom, and 112 to Belgium, compared with 28,555, 22,624, 5,346, 585, and no tons, respectively, in 1948. In addition, 31,529 tons of rods, strips, sheet, and tubing and 3,514 of scrap were shipped from the country compared with 28,639 and 5,236 tons, respectively, in 1948.

Chile.—Mine and smelter production of Chilean copper declined in 1949 because of lower outputs at all of the three large copper-producing mines. Martial law in effect [6] in mining zones was suspended January 27, 1949. It was reimposed, however, August 22, owing to disorders in Santiago and in the coal fields, attributed to Communist activities; it remained in effect at the end of the year.

Continuation of the conditions of inadequate supply of skilled underground labor for 3 years at the Braden mine, Kennecott Copper Corp., caused mine development to lag behind production requirements. Thus a large-scale development program was necessary in 1949 to prepare the mine for future production. At the Braden mine, 7,914,000 short tons, assaying 2.14 percent copper, were mined and milled. Smelter output was 139,592 tons of copper, compared with 164,252 tons in 1948.

The Chuquicamata mine of the Chile Exploration Co., a subsidiary of the Anaconda Copper Mining Co., produced 193,001 short tons of copper in 1949 compared with 229,285 tons in 1948, a continuation of the decrease from 243,565 tons in 1947. Ore treated averaged 1.59 percent copper in 1949. Construction of the new plant for treatment of sulfide ores proceeded continuously on the schedule of completing the plant and bringing it into operation during the first half of 1952.

At the Andes mine 54,421 tons of ore were produced, a 27-percent drop from 74,529 tons in 1948. The company is now [7] mining sulfide ores only and is producing 3,500 to 4,000 metric (3,900–4,400 short) tons a month, compared with 5,000 to 5,500 (5,500–6,100) previously. Sulfide ore reserves, it is said, will permit 15 years' operations at the current rate of depletion. Ore processed in 1949 averaged 0.968 percent copper.

The Chilean-owned small and medium-size mining industry had little activity in 1949. Construction of the Paipote national smelter, near Copiapo, was being pushed at the year's end. The Government granted subsidy during the year to high-cost, small mines.

[6] Kennecott Copper Corp., 1949 Annual Report to Stockholders.
[7] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 6, June 1950, pp. 13-15.

Exports of the chief copper classes, by countries, are shown as follows, in metric tons:

	Electrolytic	Standard (furnace refined)	Total
United States	188, 405	47, 536	235, 941
France	31, 089	4, 500	35, 589
Great Britain	16, 978	6, 934	23, 912
Italy	5, 690	11, 218	16, 908
Brazil	11, 582	388	11, 970
Poland	--------	5, 334	5, 334
Germany	4, 088	1, 193	5, 281
Netherlands	3, 022	152	3, 174
Belgium	2, 700	--------	2, 700
Algeria	2, 405	--------	2, 405
Argentina	2, 139	--------	2, 139
Switzerland	1, 930	--------	1, 930
Denmark	1, 413	277	1, 690
Spain	1, 380	--------	1, 380
Sweden	846	381	1, 227
Other countries	2, 209	--------	2, 209
Total	275, 876	77, 913	353, 789

Other copper exports from Chile, all to the United States, were 1,176 metric tons of ore, 14,021 tons of concentrates, 130 tons of precipitates, and 181 tons of cement copper.

Cyprus.—The principal producer, the Cyprus Mines Corp. operated its Mavrovouni mine throughout the year,[8] except for a 5-day fire, and produced 723,980 tons of pyrites from which the treatment plant at Xeros recovered 99,290 tons of copper concentrate averaging 18.6 percent Cu, 415,366 tons of flotation pyrites averaging 49.3 percent S, and 1,611 tons of cement copper averaging 59.2 percent Cu. A further 85,997 tons of copper pyrites was added to the stockpile. Exports included 77,820 tons of copper pyrites to Italy, 65,165 tons of copper concentrates to Germany, and 46,225 tons to the United States and 2,010 tons of cement copper (destination not given); the copper content of total copper-bearing exports was estimated at 23,558 tons. The Skouriotissa mine remained closed in 1949, but extensive investigations were made of the possibility of working the remainder of the ore body by open-cut methods. Drilling was also done at the Apliki mine, with no ore of commercial grade encountered thus far.

Finland.—Outokumpu Oy, owned by the Finnish Government and by far the largest copper producer in Finland, is said [9] to be producing 20,000 to 21,000 tons of electrolytic copper a year, all of which is believed to be oxygen-free. Originally the smelter at Harjavalta smelted concentrates to matte electrically, the matte being then converted to blister and electrolytically refined. Since 1948, the report stated, concentrates have been smelted without use of energy other than that contained in the ore. The company also has copper, brass, and bronze foundries, a rolling mill which produces plate and strip, and a tube mill.

India.—According to a recent report,[10] the Government of India is investigating possibilities of building a copper refinery in India. Increased activity in the electrical field, it is said, will cause India's

[8] The Mining Journal, Cyprus Mineral Output Booms in 1949: Vol. 234, No. 5986, May 12, 1950, p. 490.
[9] Metal Bulletin (London), No. 3450, Dec. 13, 1949, p. 16.
[10] Chemical Age (London), vol. 62, No. 1592, Jan. 14, 1950, p. 90.

consumption to rise from 35,000 to probably 60,000 tons. Present production averages only about 7,000 tons annually from the Singhbhum district, Bihar, the only productive area. Small deposits are said [11] to be numerous, however, especially in parts of Rajputana and Bihar, and investigations suggest the occurrence of copper lodes in Darjeeling, Sikkim and Kumaon Himalayas, and elsewhere.

Northern Rhodesia.—Mine and smelter production of copper in Northern Rhodesia made noteworthy gains in 1949. Inadequate rail facilities and a consequent shortage of coal, however, continued to hamper full-scale operations, though more intensive wood burning permitted an increase in over-all operations as compared with 1948. A new subsidiary with which all the copper-mining companies are associated is the Northern Rhodesia Power Corp., Ltd.,[12] which is arranging for the interconnection of the electrical power systems of the four mines and will explore the possibilities of hydroelectric power from the Kariba, Kafue, and other sources. This plan will permit economies in necessary standby equipment and in extensions to the power plants needed to meet anticipated increased demand.

Satisfactory progress was reported in extensions being made to the electrolytic refinery of the Rhodesian Copper Refineries.

A total of 3,060,100 short dry tons of ore, containing 2.35 percent copper, was mined at the Roan Antelope mine in the fiscal year ended June 30, 1949, or 6 percent more than in the preceding 12 months. Production of blister copper amounted to 62,901 short tons in 1948–49 compared with 57,968 tons in 1947–48. Ore reserves at the end of June 1949 were estimated at 92,706,087 tons, containing 3.25 percent copper.

The Rhokana Corp., Ltd., produced 122,418 (106,254 in 1947–48) short tons of copper in the year ended June 30, 1949, of which 13,734 (13,108 tons in 1948) tons were Nkana blister copper, 38,438 (28,843) Nchanga blister, and 70,246 (64,573) Nkana electrolytic copper. Ore reserves at the end of June 1949 were as follows:

	Short tons	Copper (percent)
Nkana north ore body	32, 160, 000	3. 20
Nkana south ore body	20, 165, 000	2. 78
Mindola ore body	54, 963, 600	3. 64
	107, 288, 600	3. 35

The extension program at Nchanga—to increase production to 64,000 long (72,000 short) tons of copper—was reported to have progressed satisfactorily and was expected to be completed by the end of 1950. According to the Yearbook of the American Bureau of Metal Statistics for 1949, reserves at the Nchanga mine in 1949 were 139,674,000 short tons, averaging 4.66 percent copper.

The Mufulira Copper Mines, Ltd., mined 2,973,935 short dry tons of ore, averaging 3.12 percent copper, in the year ended June 30, 1949. Blister copper output was 79,482 tons compared with 59,763 in 1947–48. Ore reserves on June 30, 1949, were 129,304,000 tons, averaging 3.85 percent copper, in the Mufulira, Chambishi, and Baluba mines. Block caving has been introduced to replace sublevel caving at the Mufulira mine and about 56 percent of the tonnage hoisted was obtained by the replacement method.

[11] The Metal Bulletin (London), Mineral Resources of India: No. 3410, July 22, 1949, p. 8.
[12] The Rhodesia Mining Review, No. 171 (new series), December 1949, p. 21.

Mining methods at Mufulira were described in the December Bulletin of the Institute of Mining and Metallurgy and later condensed.[13]

U. S. S. R.—The metal Bulletin[14] published estimates on the primary metal outputs of the Soviet Union, based on official indications and other sources. According to the estimates, output of copper in the U. S. S. R. was as follows:

	Metric tons		*Metric tons*
1944	170,000	1948	200,000
1945	160,000	1949	225,000
1946	170,000	1950 (target)	250,000
1947	185,000		

These figures are higher than other estimates available to the Bureau of Mines and incorporated in the table on world production.

United Kingdom.—Second only to the United States as a consumer of copper, the United Kingdom used 496,720 long tons in 1949 (of which 318,736 were virgin copper and 177,984 scrap), a drop of 8 percent from the 538,655 tons (of which 356,793 were virgin and 181,862 scrap) in 1948. Of the totals shown for 1949, 305,614 tons were used in unalloyed form, 180,227 as alloys (chiefly brass), and 10,879 in copper sulfate. Stocks of virgin blister and refined copper (Government and industry) in the United Kingdom totaled 129,674 tons at the end of 1949 compared with 120,721 at the year's beginning. These inventories include electrolytic (including rods), fire-refined, and blister and stocks in transit in the United Kingdom.

At the beginning of the year the price of the British Ministry of Supply was £140 a long ton (25.2 cents a pound), but it was dropped to £104 (18.7 cents) on July 12. After devaluation of the pound in September, the price rose to £140 a ton again but then was equivalent to only 17.5 cents a pound. A further increase to £153 (19.1 cents) occurred on November 4. Statutory maximum prices for copper, lead, and zinc were revoked, as of November 15, 1949.

Imports of the important classes in 1949, in long tons, were as follows:

Source:	*Electrolytic*	*Standard*	*Total*
Northern Rhodesia	36,559	112,887	149,446
Canada	53,267		53,267
United States	24,137		24,137
Chile	1,883	21,960	23,843
Belgium	21,824		21,824
Belgian Congo	17,249		17,249
Other countries	20,660	290	20,950
Total	175,579	135,137	310,716

The gross weight of copper ore imported—all but 2 tons from Canada—was 32,773 tons. Exports in 1949 were as follows:

	Long tons
Copper ingots, etc	32,109
Plates, sheets, rods, etc	14,808
Wire (including uninsulated electric wire)	31,377
Tubes	6,102
Other manufactures	5,126
Total	89,522

[13] Norrie, J. P., and Pettijohn, W. T., Mining Methods at Mufulira: Mining Eng., vol. 187, No. 6, June 1950, pp. 666–671.
[14] The Metal Bulletin (London), No. 3455, Jan. 3, 1950, p. 7.

Feldspar

By Robert W. Metcalf

GENERAL SUMMARY

PRODUCTION of crude feldspar in 1949 declined 20 percent and sales of ground feldspar 24 percent compared with 1948 figures and were the lowest since 1944 and 1945, respectively. Total values decreased 11 percent for crude and 13 percent for ground feldspar. Factors contributing to this decline were the reduction in glass container shipments about the middle of the year, the general slackening of business activity, and increasing competition from nepheline syenite, aplite, and to some extent blast-furnace slag. Aplite production also declined, but less sharply than feldspar. Imports of Canadian crude feldspar in 1949 dropped nearly 50 percent. Although imports of unground nepheline syenite were about one-quarter less than in 1948, receipts of ground nepheline syenite more than doubled in 1949.

Salient statistics of the feldspar industry in the United States, 1940–44 (average), and 1946–49

	1940–44 (average)	1946	1947	1948	1949
Crude feldspar:					
Domestic sales:					
Long tons	316,275	508,380	459,910	460,713	369,378
Value	$1,559,673	$2,594,690	$2,416,940	$2,564,387	$2,278,441
Average per long ton	$4.93	$5.10	$5.26	$5.57	$6.17
Imports:					
Long tons	11,149	16,365	16,665	31,047	15,836
Value	$80,467	$127,654	$124,587	$219,785	$107,925
Average per long ton	$7.22	$7.80	$7.47	$7.08	$6.82
Ground feldspar:					
Sales by merchant mills:					
Short tons	329,395	470,180	482,799	506,463	388,707
Value	$3,565,610	$5,344,107	$5,861,141	$6,462,231	$5,608,101
Average per short ton	$10.83	$11.37	$12.14	$12.76	$14.43

Sales of crude feldspar in Arizona, Connecticut, and Georgia were higher in 1949 than in 1948. Virtually all other States reported decreased tonnages, ranging from about 2 to 20 percent or more. North Carolina continued to be the largest producing State, with 44 percent of the total output in 1949. All States reporting ground feldspar in 1949 reported losses in tonnage except Georgia. Connecticut-New Jersey, Virginia, and Arizona had moderate declines in ground feldspar sold, and the other grinding States all reported substantial decreases, including an 18-percent decline for New York and a 27-percent drop for North Carolina-Tennessee. Toward the end of 1949, however, both crude and ground feldspar experienced a considerable resurgence, and production at the end of the year was at a high level.

DOMESTIC PRODUCTION

CRUDE FELDSPAR

Production of crude feldspar in 1949 decreased 20 percent to the lowest point since 1944, and the total value decreased 11 percent compared with 1948. The average value per ton rose 11 percent to $6.17. Feldspar in 1949 was mined in 13 States, compared with 12 in 1948, Texas again reporting a small output.

Crude feldspar sold or used by producers in the United States, 1944–49

Year	Long tons	Value: Total	Value: Average	Year	Long tons	Value: Total	Value: Average
1944	327,406	$1,813,937	$5.54	1947	459,910	$2,410,940	$5.24
1945	373,054	2,021,529	5.42	1948	460,713	2,564,387	5.57
1946	508,380	2,594,099	5.10	1949	369,378	2,278,441	6.17

Crude feldspar sold or used by producers in the United States, 1947–49, by States

State	1947		1948		1949	
	Long tons	Value	Long tons	Value	Long tons	Value
Colorado	43,676	$218,593	62,497	$253,227	60,966	$341,049
Connecticut	15,408	100,152	12,110	78,772	12,659	95,044
Maine	16,898	97,565	18,774	130,486	18,286	130,275
North Carolina	220,997	1,061,514	201,774	1,116,825	160,916	973,431
South Dakota	58,959	284,378	54,037	270,889	32,272	156,548
Virginia	41,820	261,741	34,770	231,607	33,936	234,442
Wyoming	18,801	90,258	16,760	78,080	(1)	(1)
Undistributed [2]	43,351	276,739	59,991	404,501	50,343	347,652
Total	459,910	2,410,940	460,713	2,564,387	369,378	2,278,441

[1] Included with "Undistributed."
[2] Includes Arizona, California, Georgia, Maryland (1947), New Hampshire, New York, Texas (1947 and 1949), and Wyoming (1949).

Output of crude feldspar in Arizona and Connecticut was slightly higher than in 1948. Although relatively small in actual tonnage, production in California and Georgia made large proportional gains. All other States in 1949 showed losses in tonnage, varying from 2 or 3 percent for Colorado, Maine, and Virginia to 20 percent for North Carolina and even higher percentages for several of the other States. The largest producing State, as for many years, was North Carolina, with 44 percent of the total output, followed by Colorado with 17 percent, and Virginia and South Dakota each with 9 percent of the total.

GROUND FELDSPAR

The output of ground feldspar by merchant mills in 1949 dropped 24 percent to 336,707 short tons, the lowest figure since 1945. The total value decreased 13 percent, and the average value per ton rose 14 percent to $14.50. Ground feldspar was produced in 14 States in 1949 compared with 13 in 1948, California again reporting a small tonnage. Georgia was the only State in which more feldspar was ground in 1949

than in 1948. Shipments by Colorado mills totaled 18 percent of the total sales in 1949, compared with 16 in 1948 and 14 in 1947. Sales by North Carolina-Tennessee mills in 1949 were 41 percent of the total feldspar ground, compared with 43 percent in 1948 and 45 percent in 1947, and shipments by Maine grinding plants were about 4 percent of the total sales in each of these 3 years.

Ground feldspar sold by merchant mills [1] in the United States, 1945–49

Year	Active mills	Domestic feldspar			Canadian feldspar			Total	
		Short tons	Value		Short tons	Value		Short tons	Value
			Total	Average		Total	Average		
1945	30	372,377	$4,062,077	$10.91	9,351	$184,884	$19.77	381,728	$4,246,961
1946	28	454,868	5,029,330	11.06	15,330	316,777	20.66	470,199	5,346,107
1947	26	464,179	5,461,576	11.77	18,521	399,565	21.57	482,700	5,861,141
1948	28	487,070	5,991,059	12.30	19,381	471,172	24.31	506,451	6,462,231
1949	27	369,824	5,212,246	14.09	16,883	396,855	23.51	386,707	5,609,101

[1] Excludes potters and others who grind for consumption in their own plants.

North Carolina again was the largest grinder of feldspar, followed by Colorado, Virginia, and South Dakota. Connecticut-New Jersey, Virginia, and Arizona showed moderate decreases compared with 1948, and the other producing States reported large declines in output, ranging from 18 percent for New York to 27 percent for North Carolina-Tennessee and higher for certain other States.

Ground feldspar sold by merchant mills [1] in the United States, 1947–49, by States

State	1947			1948			1949		
	Active mills	Short tons	Value	Active mills	Short tons	Value	Active mills	Short tons	Value
Colorado	2	66,940	$616,973	2	81,049	$826,476	2	69,274	$727,959
Connecticut	2	24,537	426,952	2	23,412	446,060	2	21,572	437,050
New Jersey	1			1			1		
Maine	3	17,414	280,154	3	20,789	347,492	3	16,742	295,227
North Carolina	4	217,109	2,360,352	4	219,720	2,377,080	4	159,788	2,203,604
Tennessee	2			2			1		
Undistributed [2]	12	156,700	2,176,710	14	161,481	2,466,173	14	119,331	1,945,261
Total	26	482,700	5,861,141	28	506,451	6,462,231	27	386,707	5,609,101

[1] Excludes potters and others who grind for consumption in their own plants.
[2] Includes (number of active mills in parentheses) Arizona (1), California (1 in 1949), Georgia (1 in 1948–49), Illinois (1), New Hampshire (2 in 1947, 3 in 1948–49), New York (3), South Dakota (3 in 1947–48, 2 in 1949), and Virginia (2).

The Colorado feldspar industry and the operations of the Parkdale, Colo., flotation mill of the Consolidated Feldspar Corp. were described.[1] A study of the pegmatites and their relation to feldspar occurrence and production in Fremont County, Colo., was published.[2]

[1] Mattson, V. L., Feldspar: Mines Mag., vol. 39, No. 4, April 1949, pp. 25–26.
Pit and Quarry, vol. 42, No. 5, November 1949, p. 77.
[2] Heinrich, E. W., Pegmatites of Eight-Mile Park, Fremont County, Colo.: Am. Mineral., vol. 33, Nos. 7–8, July–August 1948, pp. 420–448; Nos. 9–10, September–October 1948, pp. 550–587; Am. Ceram. Soc. Jour., vol. 32, No. 3, Mar. 1, 1949, pp. 89–90.

The new feldspar plant of the Appalachian Minerals Co., Monticello, Ga., and methods of processing were described in detail.[3] A study of the pegmatites in Montana included data on the occurrences of feldspar in that State.[4] The pegmatites of the Spruce Pine area in North Carolina were described.[5] Mining, crushing, and milling methods used by the Feldspar Flotation Corp., Spruce Pine, N. C., were presented in the trade press.[6] The process was developed by two associated companies—Feldspar Milling Co., Burnsville, N. C., and North Carolina Feldspar Corp., Erwin, Tenn.—in cooperation with Tennessee Valley Authority and the North Carolina State College Minerals Research Laboratories at Asheville.

CONSUMPTION AND USES

Crude Feldspar.—Many of the merchant grinders also mine feldspar, either themselves or through affiliated firms. A large part of the crude feldspar mined, however, is obtained from small operators who sell their product principally to the merchant mills. The tonnage of feldspar and feldspathic rock treated in flotation plants is increasing.

Most of the consumers of feldspar buy material already ground, sized, and ready for use in their products from the merchant grinders. Some pottery and enamel manufacturers and soapmakers, however, purchase all or part of their requirements in crude form and crush or grind it to their own specifications in their own mills. Some Canadian crude spar is purchased direct by consumers in this country. Manufacturers of artificial teeth annually consume a small tonnage of very carefully selected crude spar, which must be free from grit and is marketed at a considerable premium over No. 1 grade commercial feldspar.

Ground Feldspar.—The ceramic industries in 1949 consumed 99 percent of the feldspar ground in merchant mills in the United States, compared with 98 percent in 1948 and 1947. Glass represented 52

Ground feldspar sold by merchant mills in the United States, 1947–49, by uses

Use	1947		1948		1949	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Ceramic:						
Glass	266,720	55.3	270,065	53.3	199,852	51.7
Pottery	183,829	38.1	202,905	40.1	158,218	40.9
Enamel	24,159	5.0	25,282	5.0	25,351	6.6
Other ceramic uses	60				30	
Soaps and abrasives	7,871	1.6	8,135	1.6	3,142	.8
Other uses	61		64		114	
Total	482,700	100.0	506,451	100.0	386,707	100.0

[3] Lenhart, Walter B., Feldspar for Glass Manufacture Rock Products, vol. 52, No. 10, October 1949, pp. 94–96.
Pit and Quarry, Feldspar from Jasper County: Vol. 42, No. 4, October 1949, pp. 65–67, 74.
Mining Congress Journal, vol. 35, No. 10, October 1949, p. 56.
[4] Heinrich, E. W., Pegmatite Mineral Deposits in Montana: Montana Bureau of Mines and Geology Memoir 28, Montana Sch. Mines, Butte, Mont., 1949, 56 pp.
[5] Jones, Waldo H., Pegmatites of Spruce Pine District, North Carolina: Mineralogist, vol. 17, No. 6, June 1949, pp. 283–285.
[6] Brunenkant, Edward J., Feldspar Flotation: Pit and Quarry, vol. 42, No. 6, December 1949, pp. 55–57.

percent of the total; pottery, 41 percent; enamel, about 6 percent; and other uses, including soaps and abrasives, 1 percent. Shipments to glass factories and pottery manufacturers in 1949 decreased 26 and 22 percent, respectively, compared with 1948, and sales to makers of enamelware were slightly above the 1948 figure.

In 1949 ground feldspar was shipped into at least 30 States and 5 foreign countries. The larger consuming areas, however, were confined to six States—Pennsylvania (15 percent of the total shipments), Ohio (14 percent), Illinois (13 percent), New Jersey (11 percent), West Virginia (8 percent), and Indiana (7 percent)—totaling 68 percent of all sales. Other States consuming fairly large amounts of ground feldspar were New York, Maryland, Oklahoma, Texas, and Wisconsin. The only important State for which an increase was reported was Oklahoma. California and Ohio showed only slight decreases in 1949 compared with 1948, and other States for which figures are given were substantially less than in 1948.

Ground feldspar shipped from merchant mills in the United States, 1944–49, by destinations, in short tons

Destination	1944	1945	1946	1947	1948	1949
California	9,788	8,735	8,641	7,395	8,406	8,385
Illinois	49,434	53,114	68,737	72,212	66,064	51,202
Indiana	40,057	47,321	47,756	44,864	37,774	25,962
Maryland	7,593	9,411	18,374	19,531	19,832	16,371
Massachusetts	3,508	3,258	3,009	3,906	4,437	1,944
New Jersey	38,158	35,735	41,340	43,969	52,587	44,343
New York	21,886	19,006	19,420	20,279	20,887	19,900
Ohio	41,206	48,151	47,031	63,939	64,805	52,533
Oklahoma	(1)	(1)	14,411	13,348	13,315	15,723
Pennsylvania	47,803	47,217	70,706	84,026	87,021	57,160
Tennessee	4,983	8,881	18,337	10,263	10,211	7,917
West Virginia	45,658	56,653	66,024	51,129	60,310	30,393
Wisconsin	7,993	7,058	10,317	9,958	11,741	10,749
Other destinations [2]	25,132	35,189	36,096	37,961	49,061	44,226
Total	343,201	381,728	470,199	482,700	506,451	396,797

[1] Included with "Other destinations"; separate figure for State not available.
[2] Includes Alabama, Arkansas, Colorado, Connecticut, District of Columbia, Florida, Hawaii, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Oklahoma (1944–45), Puerto Rico, Rhode Island, South Carolina, Tennessee, Texas, and Washington and shipments that cannot be segregated by States; also small shipments to Canada, England, Mexico, and other countries.

PRICES

Quotations on crude feldspar do not appear in the trade journals. Average values per ton, however, are computed from the annual questionnaires received from producers by the Bureau of Mines. In 1949 the average realization for all feldspar mined in the United States was $6.17 per long ton, an 11-percent increase over that for 1948 ($5.57). Average values for Arizona and South Dakota declined, but all other important producing States had higher realizations in 1949 than in 1948, the increases ranging from 2 to 4 percent for Georgia, Maine, and Virginia, up to 9 percent for North Carolina, 13 percent for New Hampshire, 16 percent for Connecticut, and 38 percent for Colorado.

The average realization per short ton for ground feldspar in 1949 rose to $14.50 compared with $12.76 in 1948, an increase of 14 percent. Most States had higher average values per ton in 1949 than in 1948,

and the five States indicating declines showed decreases of only 1 to 4 percent. The relative increases in realization varied from 3 percent for Colorado to 27 percent for North Carolina-Tennessee. Average values for the larger producing States ranged from $10.51 for Colorado to $23.24 for New York.

According to E&MJ Metal and Mineral Markets, quotations on ground feldspar in 1949 did not change from 1948 and were as follows: North Carolina, bulk carlots, 200-mesh, $18.50 per short ton; 325-mesh, $22.50; glass spar, No. 17, $12.50, and semigranular, $11.75. (Bags and bagging added $3 per ton to bulk quotations.) Virginia feldspar also remained at the same levels during 1949 as follows: No. 1, 230-mesh, $18.50 per ton, and 200-mesh, $17.50; No. 17 glassmakers' spar, $11.75, and No. 18, $12.50. Enamelers' spar was quoted at $15 to $17 throughout the year.

FOREIGN TRADE [7]

Imports for consumption of crude feldspar in 1949 totaled 15,826 long tons valued at $107,925, a drop of 49 percent in quantity and 51 percent in value compared with 1948. The tonnage of crude spar imported was the smallest since 1945, and the value the lowest since 1944. No imports of ground feldspar were reported in 1949.

Feldspar imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Crude		Ground		Year	Crude		Ground	
	Long tons	Value	Short tons	Value		Long tons	Value	Short tons	Value
1945	14,924	$114,917			1948	31,047	$219,785	(1)	$328
1946	16,365	[2] 127,517	(1)	$2	1949	15,826	107,925		
1947	16,685	124,587							

[1] Less than 1 ton.
[2] Revised figure.

As reported by the merchant grinders, the tonnage of ground feldspar destined for export in 1949 totaled 4,228 short tons, compared with 1,434 and 1,750 tons in 1948 and 1947, respectively. Countries of destination were Canada, Mexico, Peru, Belgium, and United Kingdom.

Cornwall Stone.—Imports for consumption of unmanufactured Cornwall stone in 1949 totaled 772 long tons, a large decline from the 1948 figure. Imports of ground Cornwall stone also were much less than in 1948. Both unmanufactured and ground Cornwall stone originate solely in the United Kingdom.

[7] Figures on imports are compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Cornwall stone imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Unmanufactured		Ground		Year	Unmanufactured		Ground	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1945	838	$11,317			1948	1,124	$15,633	117	$2,719
1946	456	6,031	80	$1,806	1949	772	11,200	20	572
1947	706	9,522	148	3,124					

NEPHELINE SYENITE

Nepheline syenite is a quartz-free crystalline rock consisting largely of nephelite and albite and microcline feldspar. Impurities may be the iron-bearing minerals black mica and magnetite and other minerals, such as zircon and corundum. Used originally almost entirely in glass manufacture, substantial quantities now are consumed in making pottery.

Domestic Deposits.—Nepheline syenite occurrences in New Jersey, Arkansas, and other American localities have been investigated, but all the domestic material found thus far in any appreciable tonnage has contained too much iron for ceramic purposes.

Uses.—The first and largest use for nepheline syenite is in glass manufacture, where its high alumina content is especially desirable. Following extensive research, its applications have spread into the enamel and especially the pottery trades in rising volume, both as a body component and as a part of the glaze. It is claimed that use of nepheline syenite in floor and wall tile compositions, sanitary ware, semivitreous bodies, and other ceramic products results in lower firing temperatures, greater firing range, and savings in fuel cost. Reactions of nepheline syenite-talc mixtures in low-temperature vitrified bodies also have been studied.[8] Although theoretically having piezoelectric properties, natural nepheline has not been so used because of its small, imperfect crystals.[9]

Prices.—Quotations on crude nepheline syenite are not reported in trade journals; however, crude values for this material may be approximated in the average values per ton of imports for consumption in the United States. These values were: 1945, $3.77; 1946, $3.98; 1947, $3.57; 1948, $4.01, and 1949, $4.07. According to the Oil, Paint and Drug Reporter, quotations on ground nepheline syenite during 1949 were as follows: Glass grade (24-mesh), bulk, f. o. b. Rochester, N. Y., $14.25; and pottery grade (200-mesh), bulk, f. o. b. Rochester, N. Y., $18.25. Nepheline syenite in bags was $3 per ton higher than bulk.

[8] Lynch, E. D., and Allen, A. W., Nepheline Syenite-talc Mixtures in Low-Temperature Vitrified Bodies: Am. Ceram. Soc. Jour., vol. 33, No. 4, Apr. 1, 1950, pp. 117–120.

[9] Waesche, Hugh H., Importance and Application of Piezoelectric Minerals: Mining Eng. (Mining Trans.), vol. 1, No. 1, January 1949, pp. 12–17.

Foreign Trade.—Imports of crude nepheline syenite in 1949 were 23 percent less than in 1948. Imports of ground nepheline syenite, on the other hand, rose nearly 150 percent to a new high. The increase in receipts of ground nepheline almost matched the decrease in imports of crude. Average value per ton (foreign market value) of ground nepheline syenite imported was $13.22 in 1949. Both crude and ground material were imported wholly from Canada.

Nepheline syenite imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Crude		Ground		Year	Crude		Ground	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1945	51,735	$194,975	1,073	$11,461	1948	53,570	$214,747	7,577	$130,860
1946	51,852	206,613	1,018	11,137	1949	41,215	167,567	18,779	248,224
1947	54,382	194,283							

Canada.—Supplies of nepheline syenite consumed in the United States have originated almost exclusively from the mines and plants of America Nepheline, Ltd., near Lakefield, Ontario, Canada. Most of this material has been exported in crude form and processed at the firm's Rochester, N. Y., mill. Although the total tonnage exported in 1949 did not vary greatly from that exported in 1948, the quantity of ground material in 1949 was nearly two and one-half times that in 1948. This was due to the larger utilization of the capacity of the new grinding mill placed in operation during 1948 at Lakefield. A gradual shift of grinding operations to Lakefield is planned, with an eventual closing of the Rochester plant.

Europe and Asia.—Deposits of nepheline syenite in northern European U. S. S. R. have been tested as a source of alumina, and as raw material for the manufacture of enamel and glass, but no production data are available. Other deposits have been reported in Finland and India.

APLITE

Production of aplite in 1949 declined compared with 1948. The average value per ton increased slightly. Virtually all of the aplite produced was consumed in the manufacture of glass, particularly container glass. The only producers of aplite are Dominion Minerals, Inc., Piney River, Va., and Carolina Mineral Co., Inc., Kona, N. C., in Amherst and Nelson Counties, Va., near Piney River. The Bureau of Mines is not at liberty to publish output or sales data. Announcement has been made of the establishment of an undergraduate fellowship in the Department of Glass Technology, New York State College of Ceramics, to investigate and develop uses for aplite.[10]

[10] Glass Industry, vol. 31, No. 2, February 1950, p. 111.

TECHNOLOGY

Continuing the active interest in feldspar and its applications, the Committee (C–21) on Ceramic Whitewares of the American Society for Testing Materials (ASTM) has inaugurated a program of research on the fundamental properties of feldspar.[11] The role of feldspar as a flux in whiteware manufacture was described and the merits of potash and soda spars were discussed.[12] The importance of feldspar in the making of porcelain enamel was reported.[13] Discussions of the raw materials (including feldspar) used in the ceramic industries were presented.[14]

The use of slag as a competitive material in the glass batch apparently is growing,[15] and tests of dolomite as a substitute for feldspar in the making of floor tile have been reported.[16] The composition of stoneware glazes and the reactions of the various components including feldspar were studied.[17] The difficulties in drilling quartz-feldspar intergrowths (graphic granites) were reported.[18]

The general features, internal structure, mineralogy, and origin of the granitic pegmatites in the principal pegmatitic areas in the United States were presented in a recently published monograph.[19] A study of some of the perthite pegmatites of the Black Hills, South Dakota, was published.[20]

WORLD REVIEW

The world output of feldspar in 1949 was estimated at 660,000 metric tons, a 13-percent decrease compared with 1948. Not included in the total is production in China, Peru, and U. S. S. R., for which countries no data are available.

Although United States, Canadian, Norwegian, and Italian output each showed a considerable decline, production in Australia, Finland, Germany (Bavaria), and the Union of South Africa registered gains, not large enough in the aggregate, however, to offset the smaller outputs for other chief producing countries. The ratio of United States production to total known estimated world output in 1949 was 57 percent compared with 62 percent in 1948.

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[11] ASTM Bulletin, Committee C–21 on Ceramic Whitewares, No. 161, October 1949, p. 16.

[12] Ceramic Industry, Feldspar, Major Role in Whiteware Bodies: Vol. 53, No. 5, November 1949, p. 28.

Mining Journal, vol. 232, No. 5930, Apr. 16, 1949, p. 279.

[13] Ceramic Industry, Feldspar, Nearly 50 Percent of Enamel Batch: Vol. 52, No. 2, February 1949, p. 69.

[14] Kraner, Hobart M., New Horizons in Ceramics: Eng. Exp. Sta. News (Ohio State Univ.), vol. 21, No. 3, June 1949, p. 39.

Ottoson, A., Better Raw Materials for the Glass Industry: Glass Ind., vol. 29, No. 5, May 1949, pp. 251–252, 288–289.

[15] Glass Industry, vol. 31, No. 1, January 1950, p. 45.

[16] Morse, G. T., Use of Dolomite as Auxiliary Flux in Floor Tile: Am. Ceram. Soc. Jour., vol. 31, No. 3, Mar. 1, 1948, pp. 67–70.

[17] Driscoll, Harold, Studio Stoneware Glazes: Ceram. Age, vol. 54, No. 5, November 1949, pp. 318–322.

[18] Armstrong, L. C., Diamond-Drilling Quartz-Feldspar Intergrowths: Mining Eng., vol. 1, No. 6, sec. 3, June 1949, pp. 177–178.

[19] Cameron, E. M., Jahns, R. H., McNair, A. H., and Page, L. R., Internal Structure of Granitic Pegmatites: Econ. Geol. Pub. Co., Urbana, Ill., 1949, 115 pp.

[20] Higazy, Riad A., Petrogenesis of Perthite Pegmatites in the Black Hills, S. Dak.: Jour. of Geol., vol. 57, No. 6, November 1949, pp. 555–581.

World production of feldspar, by countries,[1] 1943–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1943	1944	1945	1946	1947	1948	1949
Argentina (shipments)	2,000	3,468	5,375	4,755	5,000	(2)	(2)
Australia:							
New South Wales	3,890	4,756	3,785	4,844	5,363	6,521	(2)
South Australia [3]	522	818	955	1,317	1,958	2,219	2,472
Victoria	58	143	217	----	----	----	(2)
Western Australia	2,351	1,990	1,254	1,822	1,246	1,027	1,066
Austria	(2)	(2)	(2)	(2)	951	1,144	1,912
Brazil	(2)	(2)	(2)	(2)	(2)	189	(2)
Canada (shipments)	21,644	21,327	27,439	31,972	32,753	49,760	30,475
Chile	8	----	124	44	217	885	(2)
Czechoslovakia	(2)	(2)	5,944	7,171	(2)	(2)	(2)
Egypt	32	50	40	----	----	----	(2)
Eritrea	(2)	(2)	(2)	50	150	(2)	(2)
Finland	3,571	3,584	3,400	3,620	6,781	6,064	10,074
France	19,340	9,609	16,372	28,190	44,104	(2)	(2)
Germany: Bavaria	12,824	41,200	(2)	[4] 18,000	21,251	32,921	49,544
India	1,340	343	340	1,304	1,750	1,003	(2)
Israel and Jordan	85	65	37	53	19	(2)	(2)
Italy	6,664	1,474	854	6,244	10,727	13,469	10,901
Japan	[5] 2,939	[5] 2,313	[5] 1,377	[6] 7,514	21,496	[7] 25,077	[7] 20,055
Kenya	(2)	(2)	110	44	36	10	20
Madagascar	2	34	----	12	----	(2)	(2)
Norway	5,712	7,987	4,244	5,332	[8] 23,513	[8] 30,130	[8] 21,932
Portugal	(2)	639	678	856	1,137	(2)	(2)
Rumania	1,261	(2)	(2)	(2)	(2)	(2)	(2)
Spain	1,093	2,567	[9] 1,400	2,804	2,049	9,807	(2)
Sweden	25,879	15,537	15,172	25,276	37,953	38,687	(2)
Union of South Africa	----	669	635	1,382	1,676	2,101	3,259
United Kingdom: Northern Ireland	203	172	----	----	----	(2)	(2)
United States (sold or used)	313,126	332,663	379,042	516,539	467,292	468,107	375,307
Uruguay	(2)	264	[4] 265	513	843	4,877	811
Total [10]	440,000	465,000	500,000	675,000	700,000	760,000	660,000

[1] In addition to countries listed, feldspar is produced in China, Peru, and U. S. S. R., but data are not available.
[2] Data not available; estimate by author of chapter included in total.
[3] Includes some china stone.
[4] Estimate.
[5] Data for fiscal year ended March 31 of year following that stated.
[6] January to October, inclusive.
[7] In addition, the following quantities of aplite and other feldspathic rock were produced: 1948: 35,840 tons; 1949: 50,943.
[8] Exports.
[9] January to September, inclusive.
[10] Estimated by author of chapter. No estimates included for countries listed in footnote 1.

A brief discussion of the Canadian occurrences of feldspar and the rocks and minerals which may be used as substitutes was presented.[21] Reference to feldspar deposits in Manitoba was made in a review of possible industrial mineral developments.[22] Occurrence and description of labradorite were presented.[23] An increasing demand during 1949 was noted in France's principal feldspar producing area.[24] A small-scale feldspar operation was reported from Peru.[25] Sources and production statistics were given for a wide variety of minerals including feldspar in Australia and New Guinea.[26]

[21] Canadian Mining and Metallurgical Bulletin, vol. 42, No. 442, February 1949, p. 51.
[22] Canadian Mining and Metallurgical Bulletin, A Review of Industrial Minerals Developments in Manitoba: Vol. 42, No. 441, January 1949, p. 15.
[23] Mineralogist, Canada Labradorite: Vol. 17, No. 9, September 1949, pp. 440, 442.
[24] Chemical Age, Rising Request for Feldspar: Vol. 61, No. 1571, Aug. 20, 1949, p. 265.
[25] Engineering and Mining Journal, vol. 50, No. 6, June 1949, pp. 130–131.
Common
Ins
No. 5, May 1, 1949, p. 135.

Ferro-Alloys

By Norwood B. Melcher

GENERAL SUMMARY

A SHARP decline in the production and shipment of ferro-alloys in 1949 resulted in part from a 12-percent drop in the output of steel ingots and castings during the year but more particularly from a 26-percent decline in the shipments of alloy steels during the year. Consequently, such alloys as manganese and silicon, which are related to the total output of steel, declined far less than those alloying materials which are used primarily for their alloying effects. Manganese and silicon may both be considered as scavengers in that they either remove objectionable impurities or render them relatively harmless. Silicon is used mainly in removing oxygen from steel, and manganese removes oxygen and sulfur, but more important, it combines with sulfur in steel and minimizes the difficulties in hot rolling which results when sulfur is combined with iron rather than manganese.

Ferro-alloys are peculiar in their use in that they have no particular value in themselves and do not reach the ultimate consumer as such. Their main use is in the manufacture of various types of steels, and in fact the production of modern steels depends upon the availability of these materials. Hence, with few exceptions these alloying materials receive the highest priority as strategic materials and are on the National Stockpile list. The exceptions are silicon, phosphorus, titanium, and zirconium, which are considered the only ones available in sufficient quantities for an emergency period. As would be suggested from this fact, most of these critical materials are obtained largely from foreign sources. Silicon is produced in the United States and nearby Canada in tonnages sufficient to meet all anticipated requirements, and the bulk of the vanadium requirements are obtained from domestic sources. The United States produces about 90 percent of the world supply of molybdenum, but the fact that a large portion of the United States supply of this metal is obtained from one large underground mine requires that this material be given special consideration. Ferro-alloys are produced in blast furnaces, electric furnaces, and by aluminothermic processes.

Of all the ferro-alloys, only one containing a high percentage of the rare alloying metal, ferromanganese, is produced mainly in blast furnaces, although the low-carbon ferromanganese is produced by electric methods. Spiegeleisen, the 20-percent manganese material, is produced by blast furnaces, and the lower grades of ferrosilicon (under 13 percent) are produced by this method. Most of the molybdenum alloys and a small part of the ferrotitanium are produced by the aluminothermic process, where powdered aluminum is used as a reducing agent.

The ferro-alloying ores of metals are discussed in detail in chapters of this volume dealing with particular metals. These chapters are

Chromium, Manganese, Molybdenum, Titanium, Tungsten, Vanadium, and Minor Metals.

PRODUCTION AND SHIPMENTS

The production of ferro-alloys in 1949 totaled 1,544,442 net tons, compared with 1,892,521 tons in 1948, a decrease of 18 percent. In 1949, ferro-alloys were made in 13 blast-furnace plants, 29 electric-furnace plants, and 2 aluminothermic-furnace plants. In addition, 1 plant using electric furnaces produced ferrosilicon, and 6 produced ferrophosphorus as a byproduct. Shipments of all classes of ferro-alloys from furnaces decreased 27 percent in quantity but only 19 percent in value from 1948, indicating the higher level of prices during the year. Pennsylvania again led all other States in production and shipments of ferro-alloys, producing 31 percent of the United States total tonnage and 39 percent of the value, compared with 33 percent and 40 percent, respectively, in 1948. This State, however, decreased its production 23 percent from 1948. New York was the second largest State from a standpoint of production, supplying 15 percent of the tonnage and 20 percent of the value. Production and shipments of ferro-alloys also were reported from Alabama, California, Florida, Indiana, Iowa, Kentucky, Montana, New Jersey, Ohio, Oregon, South Carolina, Tennessee, Virginia, Washington, and West Virginia.

Ferro-alloys produced and shipped from furnaces in the United States, 1948–49

Alloy	1948			1949		
	Production (net tons)	Shipments: Net tons	Shipments: Value	Production (net tons)	Shipments: Net tons	Shipments: Value
Ferromanganese	647,617	659,193	$90,126,657	577,345	560,180	$86,463,708
Spiegeleisen	112,810	108,960	5,261,650	78,167	53,888	2,972,653
Ferrosilicon	814,297	818,974	71,711,831	647,961	590,168	55,415,405
Ferrophosphorus	32,297	72,453	2,006,254	35,046	19,874	748,086
Ferrotungsten	2,394	2,305	7,190,027	1,376	1,091	2,090,342
Ferrotitanium, Ferrovanadium	9,929	8,161		5,528	6,179	
Ferromolybdenum, Molybdic oxide, Calcium molybdate and compounds	20,737	21,443	97,154,001	17,299	14,778	72,214,133
Other ferro-alloys [1]	253,610	260,757		181,700	178,704	
Total	1,892,521	1,952,246	273,450,420	1,544,442	1,424,862	220,504,328

[1] Silicomanganese, manganese briquets, ferrochromium, ferrocolumbium, ferroboron, zirconium-ferrosilicon, and miscellaneous ferro-alloys.

Ferromanganese.—The ferromanganese produced in 1949 averaged 78.33 percent manganese and came from four electric and seven blast-furnace plants. Of the manganese ore used in 1949 for the manufacture of ferromanganese, 90 percent was foreign compared with 94 percent in 1948. During the year, 560,180 net tons were shipped from furnaces, whereas consumption totaled 617,645 tons, the difference being made up from imported material. The steel industry in using 13.2 pounds of contained manganese per ton of steel ingots produced in 1949, used most of the ferromanganese. High-carbon

Producers of ferro-alloys in the United States in 1949

Producer	Plant	Alloy
American Agricultural Chemical Co.	South Amboy, N. J.	Ferrophosphorus (byproduct).
Anaconda Copper Mining Co.	Anaconda, Mont. Black Eagle, Mont.	Ferromanganese.
Bethlehem Steel Co.	Johnstown, Pa.	Do.
Climax Molybdenum Co.	Langeloth, Pa.	Ferromolybdenum, calcium molybdate, molybdenum oxide, oxide briquets, molybdenum trioxide, sodium molybdate, ferrotungsten, molybdenum silicide, ammonium molybdate, molybdenum sulphide, cobalt molybdenum.
Electro Metallurgical Co.	Alloy, W. Va. Ashtabula, Ohio Columbiana, Ohio Holcomb Rock, Va. Niagara Falls, N. Y. Portland, Oreg. Sheffield, Ala.	Ferromanganese, silicomanganese, manganese briquets, ferrosilicon, silicon briquets, zirconium-ferrosilicon, ferrochromium, chromium briquets, ferrotungsten, ferrovanadium, ferroboron, ferrocolumbium, ferrotitanium, ferromolybdenum.
Globe Iron Co.	Jackson, Ohio	Silvery pig iron.
Hanna Furnace Corp.	Buffalo, N. Y.	Do.
Inland Steel Co.	East Chicago, Ind.	Spiegeleisen.
Jackson Iron & Steel Co.	Jackson, Ohio	Silvery pig iron.
Keokuk Electro-Metals Co.	Keokuk, Iowa	Ferrosilicon, silvery pig iron.
E. J. Lavino & Co.	Reusens, Va. Sheridan, Pa.	Ferromanganese.
Metal & Thermit Corp.	Carteret, N. J.	Ferrotitanium.
Molybdenum Corp. of America	Washington, Pa.	Ferrotungsten, ferromolybdenum, molybdic oxide, ferroboron, manganese boride.
Monsanto Chemical Co.	Anniston, Ala. Columbia, Tenn.	Ferrosilicon (byproduct), ferrophosphorus, (byproduct).
New Jersey Zinc Co.	Palmerton, Pa.	Spiegeleisen.
Ohio Ferro-Alloys Co.	Philo, Ohio. Tacoma, Wash.	Ferrosilicon, simanal, ferrochromium.
Oldbury Electro-Chemical Co.	Niagara Falls, N. Y.	Ferrophosphorus (byproduct).
Permanente Metals Corp.	Permanente, Calif.	Ferrosilicon.
Pittsburgh Metallurgical Co.	Charleston, S. C. Niagara Falls, N. Y. Calvert City, Ky.	Ferrosilicon, silvery pig iron, ferrochromium, silicomanganese.
Sloss-Sheffield Steel & Iron Co.	N. Birmingham, Ala.	Ferromanganese.
Tennessee Products & Chemical Corp. (Southern Ferro-Alloys Div.).	Chattanooga, Tenn.	Ferromanganese, ferrosilicon, silicon briquets.
Tennessee Valley Authority	Muscle Shoals, Ala.	Ferrophosphorus (byproduct).
Titanium Alloy Mfg. Div., National Lead Co.	Niagara Falls, N. Y.	Ferrotitanium.
U. S. Steel Corp. subsidiaries	Clairton, Pa. Etna, Pa. Duquesne, Pa. Gary, Ind.	Ferromanganese, spiegeleisen.
Vanadium Corp. of America	Niagara Falls, N. Y. Bridgeville, Pa.	Ferrosilicon, silicon briquets, alsifer, ferrochromium, ferrovanadium, ferrotitanium, grainals, ammonium meta vanadette, aluminum ferro-alloy, titanium aluminum.
Victor Chemical Works	Mt. Pleasant, Tenn.	Ferrophosphorus (byproduct).
Virginia-Carolina Chemical Corp.	Nichols, Fla.	Do.

ferromanganese is satisfactory for the bulk of the steel production, whereas the low-carbon alloy is used in such steels as stainless, where very low carbon is essential. Most of the ferromanganese imported in 1949 originated in Canada and Norway, but very small quantities came from Japan, China, and Korea.

Spiegeleisen.—Spiegeleisen is used for essentially the same purposes as ferromanganese but is in less demand due to the longer time required to melt and remove carbon from the product to introduce equivalent quantities of manganese metal to steel. More carbon is added to the bath per unit of manganese when spiegeleisen is used. The production of this alloy continued to decrease in 1949 dropping off 31 percent from the previous year. Shipments dropped off even more, being 51 percent less in quantity and 44 percent less in value than in 1948. This is not a desirable trend, as an equivalent require-

ment for manganese metal is thereby necessarily supplied by ferromanganese, which in turn requires the strategically important high-grade manganese ore. Shipments of spiegeleisen from furnaces in 1949 totaled 53,888 tons valued at $2,972,653 f. o. b. furnaces, or $55.16 per ton, compared with $48.29 per ton in 1948 and $39.99 in 1947. Three-tenths pound of metallic manganese in the form of spiegeleisen was used per ton of steel produced in 1949.

Ferrosilicon.—The production of ferrosilicon from a standpoint of tonnage constitutes the largest single production segment in the ferro-alloy industry. In fact, 42 percent of the total ferro-alloy production in 1949 consisted of this alloy. This total, as can be observed from an accompanying consumption table, includes numerous grades of alloys containing silicon which are unlike and are used for many purposes. For example, silvery pig iron included in the ferrosilicon figures is produced largely in blast furnaces and is used mainly in the iron-foundry industry, whereas the standard ferrosilicon (50 percent) is material used in the manufacture of steel. In 1949 the blast-furnace product averaged 9.8 percent Si as in 1948, while electric-furnace output, mostly ferrosilicon containing over 20 percent Si, averaged

Consumption of ferrosilicon, silicon metal, and miscellaneous silicon alloys in the United States in 1949, by industries, in net tons

Alloy	Steel ingots and castings [1]	Steel castings [1]	Miscellaneous	Total
Silvery pig iron: 5-20 percent silicon	61,527	16,194	249,314	327,035
Ferrosilicon:				
50 percent silicon	132,993	10,436	9,450	152,879
75 percent silicon	28,262	135	2,441	30,838
Other grades [2]	32,231	2,856	38,769	73,856
Total	255,013	29,621	299,974	584,608

[1] Data for castings made by companies that also produce steel ingots are included with "Steel ingots and castings" and excluded from "Steel castings."
[2] Includes grades of ferrosilicon not listed separately, silicon metal, and miscellaneous silicon alloys.

40 percent. Shipments of all grades of ferrosilicon (including silvery pig iron) totaled 590,168 net tons valued at $55,415,405. Of this 255,013 net tons of ferrosilicon and miscellaneous silicon alloys were consumed in the manufacture of steel ingots and castings, as published by the American Iron and Steel Institute. Fifty-two percent (132,993 net tons) was of the standard 50-percent grade, 61,527 net tons were silvery pig iron, and 28,262 tons the 75-percent grade. "Other grades" constituted the remaining 32,231 tons. The most important grade of ferrosilicon is the standard 50 percent, which is employed as a deoxidizer and solidifier in manufacturing most grades of killed and semikilled steel. Only a small quantity of alloy is used in iron foundries and other industries. Alloys containing 75-percent silicon and miscellaneous silicon alloys are used in ladle additions in gray-iron foundries and in the manufacture of high-silicon steel for use in electrical equipment and high-silicon spring steel. The accompanying table shows the consumption of the various grades of silicon alloys according to the major consuming industry groups.

Ferrophosphorus.—All ferrophosphorus in 1949 was produced in

electric furnaces as a byproduct in the manufacture of phosphate fertilizers and other chemicals. Shipments of ferrophosphorus fell precipitously during the year as a result of a comparable drop in the export market of this material. Exports, which had reached the record high of 52,988 net tons in 1948, were only 5,050 tons in 1949. Thus even with a slight increase in production of this alloy, shipments totaled only 19,874 tons valued at $748,086 compared with 72,-453 tons valued at $2,006,254 in the previous year.

Ferrotungsten.—The ferrotungsten produced in the United States during 1949 was made in the electric furnaces using both foreign and domestic ores. The total consumption of tungsten concentrates in the United States during the year was 5,210 net tons (60 percent WO_3 basis), 2,472 tons of which were consumed in the manufacture of ferrotungsten. The domestic material was obtained from nine States and Alaska in 1949, but three States—Nevada, North Carolina, and California—supplied 86 percent of the total. Imports for consumption of tungsten ores and concentrates in 1949 were equivalent to 6,592 net tons of 60 percent WO_3, a 17-percent decrease from 1948. These ores and concentrates came from 16 foreign countries in 1949; but 3—China, Korea, and Thailand—supplied 87 percent of the total.

Ferrochromium.—All of the ferrochromium output in the United States in 1949 was produced in electric furnaces and mainly from foreign ores. Generally speaking, ferrochromium is produced in two separate grades—the high-carbon, which contains more than 2 percent, and various low-carbon grades, which contain less than 2 percent with some as low as 0.03 maximum carbon. Stainless steels and high-temperature alloys are the main users of the low-carbon grade. Consumption of ferrochromium in the United States in 1949 dropped to 87,764 short tons compared with 122,753 tons in 1948 and 113,491 tons in 1947. This consumption was reported by consumers which normally use about 85 percent of the total. Exports and imports both declined from the previous year.

Ferromolybdenum.—The ferromolybdenum produced in 1949 was made by the aluminothermic process and in electric furnaces using domestic concentrates. The alloy was produced in only two plants during the year; these are in Langeloth, Pa., and Washington, Pa.

Molybdic Oxide, Calcium Molybdate, and Molybdenum Compounds.—Molybdenum compounds used in alloying agents in the production of iron and steel are included with ferro-alloys. These materials are much less expensive than ferromolybdenum and consequently are used to a greater extent. As with ferromolybdenum, virtually all these compounds are made from domestic raw materials.

Ferrotitanium.—In 1949 most of the ferrotitanium was produced in electric furnaces, but a small quantity was made by the aluminothermic process. The ferrotitanium produced in 1949 contained a higher percentage of alloy high in titanium, as indicated by the fact that the average of all grades in 1949 was 23.4 percent Ti, compared with 19.5 percent in 1948. Both foreign and domestic ores (ilmenite and rutile) were consumed in its manufacture. Ferrotitanium is used as a deoxidizer and scavenger in steel manufacture. When employed as a deoxidizer, ferrotitanium is charged in combination with silicon or some other deoxidizing agent. The titanium alloy is added as a final

purifier. As an alloying agent, ferrotitanium prevents intergranular corrosion.

Ferrovanadium.—All ferrovanadium produced in 1949 was made in electric furnaces, and both foreign and domestic ores were used in its manufacture. This alloy averaged 50 percent vanadium in 1949, compared with 48 percent in 1948 and 45 percent in 1947.

Ferrocolumbium.—Ferrocolumbium is used in stainless steel to prevent intergranular corrosion. It also reduces air hardening and oxidation at high temperature in chromium steel. In 1949 the output of ferrocolumbium averaged 57 percent columbium and was produced in electric furnaces.

Zirconium-Ferrosilicon.—The zirconium-ferrosilicon produced in 1949 averaged 14 percent Zr, as in the previous year. Zirconium, a powerful deoxidizer and scavenger, reduces hardening and thereby improves deep-drawing properties of sheet steel. It is used instead of ordinary ferrosilicon and is more effective. Zirconium, like manganese, will combine with sulfur in the steel, eliminating or reducing the harmful property of hot shortness. The addition of relatively high percentages of zirconium (over 0.10 percent) will result in fine grain sizes and will improve hardenability.

Silicomanganese.—This alloy is used to make manganese additions to steel and is used in killed steels only, because of the silicon present.

Manganese Briquets.—The foundry industry is the principal user of manganese briquets, which are added to molten iron to overcome the harmful effects of sulfur and to act as a deoxidizer and scavenger. Each of these briquets contains exactly 2 pounds of manganese; therefore they can be added without the inconvenience of weighing the material.

FOREIGN TRADE [1]

Ferromanganese continued to be the main ferro-alloy import commodity in 1949. Most of this ferromanganese was received from Canada and Norway and was manufactured from ores exported from Gold Coast. Consequently, the receipts of manganese ore as such from Gold Coast failed to represent the full picture. The alloy received from Norway and Canada was equivalent to more than 120,000 tons of manganese ore during 1949.

Exports of ferro-alloys dropped to barely one-fifth of the 1948 total with decreases noticeable in most of the alloys. The largest tonnage drops, however, were in ferrophosphorus and ferromanganese.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1948–49, by varieties

[U. S. Department of Commerce]

Variety of alloy	1948			1949		
	Gross weight (net tons)	Content (net tons)	Value	Gross weight (net tons)	Content (net tons)	Value
Calcium silicide (calcium-silicon)	[1] 215	(2)	$52,378	56	(2)	$14,977
Ferrochrome or ferrochromium containing 3 percent or more of carbon	9,019	4,714	1,470,653	7,491	4,012	1,279,598
Ferromanganese:						
Containing not over 1 percent carbon				(2)	(4)	89
Containing over 1 and less than 4 percent carbon	15,590	12,828	3,081,813	16,059	13,369	4,117,462
Containing not less than 4 percent carbon	82,630	65,598	11,434,780	48,955	38,798	7,188,058
Ferrosilicon	7,344	734	179,998	7,437	931	254,831
Ferrotitanium	28	(2)	17,346	38	(2)	20,280
Ferrotungsten				31	23	30,813
Manganese-boron, manganese metal, and spiegeleisen not more than 1 percent carbon (manganese content)			-	(2)	3	1,225
Silicon-aluminum and aluminum-silicon				125	(5)	35,929
Silicon metal (silicon content)	55	53	25,358	34	32	17,043
Spiegeleisen				1,737	(2)	86,217
Tungsten and combinations, in lump, grains, or powder: Tungsten metal (tungsten content)	(2)	(3)	366	(2)	7	21,811

[1] Revised figure. [2] Not recorded. [3] 441 pounds. [4] 370 pounds. [5] 224 pounds.

Ferromanganese and ferrosilicon imported for consumption in the United States, 1948–49, by countries

[U. S. Department of Commerce]

Country	Ferromanganese (manganese content)				Ferrosilicon (silicon content)			
	1948		1949		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Belgium-Luxembourg							(1)	$6
Canada	57,477	$9,957,681	25,783	$4,762,495	733	$179,668	931	254,825
China			9	1,407				
Italy					1	330		
Japan			11	2,543				
Korea			44	4,670				
Norway	20,949	4,558,912	26,320	6,534,494				
Total	78,426	14,516,593	52,167	11,305,609	734	179,998	931	254,831

[1] Less than 1 ton.

Ferro-alloys and ferro-alloy metals exported from the United States, 1945–49, by varieties

[U. S. Department of Commerce]

Variety of alloy	1945		1946		1947		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Spiegeleisen	2,393	$82,699	7,513	$271,827	305	$12,632	51	$2,227	-----	-----
Ferrochrome	1,471	487,755	2,510	732,221	3,081	1,057,359	6,754	2,371,367	2,200	$942,792
Ferromanganese	836	175,556	2,951	381,194	20,168	2,811,653	19,696	2,990,645	6,627	1,360,279
Ferromolybdenum	884	1,050,863	370	456,574	477	630,813	594	806,420	478	718,722
Ferrophosphorus	603	42,204	1,228	80,037	[1] 34,535	[1] 919,877	52,988	1,310,260	5,050	168,205
Ferrosilicon	1,089	114,520	3,163	244,625	1,357	187,973	2,476	427,259	2,555	436,402
Ferrotitanium and ferrocarbon-titanium	744	122,887	550	63,723	509	80,590	480	82,874	179	40,918
Ferrotungsten	431	1,344,281	91	270,325	41	134,546	628	1,838,397	310	861,189
Ferrovanadium	86	246,862	57	161,289	89	266,040	119	390,428	97	350,558
Other ferro-alloys	73	33,016	218	61,489	206	88,289	183	102,709	316	161,297
Total	8,610	3,700,643	18,651	2,723,304	[1] 60,768	[1] 6,189,772	83,969	10,322,586	17,812	5,040,362

[1] Revised figure.

Fluorspar and Cryolite

By Hubert W. Davis

GENERAL SUMMARY

SHIPMENTS of fluorspar from mines in the United States, which established a peacetime record in 1948, declined 29 percent in 1949, and imports, which reached an all-time high in 1948, dropped 14 percent. Domestic shipments in 1949 were the smallest since 1940, but imports have been exceeded by only two other years. Production of finished fluorspar also declined substantially. The smaller demand for fluorspar in 1949 was caused largely by a 15-percent decline in consumption—which resulted chiefly from a strike in the steel industry and from a lower level of operations in the hydrofluoric-acid and glass industries—and partly by an 11-percent reduction in consumers' inventory.

Illinois maintained its rank as the premier producer of fluorspar in 1949 by supplying 51 percent of the total domestic shipments. However, shipments from Illinois were 30 percent less than in 1948 and the smallest since 1940. Montana and Texas were the only States to show gains in shipments in 1949.

Calcium fluoride was produced by the Tennessee Valley Authority as a byproduct of a new fluorine-recovery system under development since May 1949 at its experimental fused tricalcium phosphate fertilizer units at Godwin, Tenn.

For the ninth consecutive year, Mexico has been the largest source of foreign fluorspar to the United States, and in 1949 it supplied 61 percent of total imports. However, imports from Mexico were 27 percent smaller than in 1948. Substantially larger imports were received from Italy and Spain. For the first time since 1940, fluorspar was received from France.

The steel industry continued to be the predominant user of fluorspar and absorbed proportionately more (58 percent) of the total consumed in 1949 than in 1948 (57 percent). The average consumption of fluorspar per long ton of basic open-hearth steel produced declined slightly from 5.86 pounds in 1948 to 5.85 pounds in 1949. The hydrofluoric-acid industry, the second largest utilizer of fluorspar, consumed 17 percent less than in 1948 and accounted for 26 percent of the total in 1949, the same share as in 1948. Consumption of fluorspar by the glass and enamel trades in 1949 declined for the second consecutive year and was 21 percent smaller than in 1948. Less fluorspar was also consumed in 1949 than in 1948 at iron foundries, nonferrous smelters, and cement plants, but more was used at plants making ferro-alloys and special fluxes.

Deliveries of fluorspar to consumers in the United States totaled 325,780 short tons in 1949 (235,921 tons from domestic mines and 89,859 tons from foreign sources). In 1948 deliveries to consumers totaled 442,336 tons (331,105 tons from domestic mines and 111,231 tons from foreign sources). Total deliveries to steel plants in the United States declined to 188,047 tons (269,304 tons in 1948), those to hydrofluoric-acid plants decreased to 86,779 tons (106,857 tons in

1948), and those to glass and enamel plants fell to 34,482 tons (45,602 tons in 1948).

Salient statistics of fluorspar in the United States, 1940–49, in short tons

Year	Shipments from domestic mines	Foreign trade		Consumption	Industry stocks at end of year		
		Imports for consumption	Exports		Domestic mines [1]	Consumers' plants	Total
1940	233, 600	11, 873	8, 482	218, 500	43, 866	102, 100	145, 966
1941	320, 669	7, 524	12, 184	303, 600	31, 997	108, 900	140, 897
1942	360, 316	2, 151	9, 020	360, 800	19, 429	96, 000	115, 429
1943	406, 016	43, 769	9, 068	388, 885	19, 026	105, 933	124, 959
1944	413, 781	87, 200	1, 980	410, 170	19, 021	98, 446	117, 467
1945	323, 961	104, 925	1, 420	356, 090	19, 863	103, 148	123, 011
1946	277, 940	29, 852	1, 729	303, 190	18, 957	98, 663	117, 620
1947	329, 484	78, 725	1, 180	376, 138	33, 101	114, 150	147, 251
1948	331, 749	111, 626	666	406, 269	37, 344	146, 869	184, 213
1949	236, 704	95, 619	802	345, 221	37, 039	130, 621	[2] 167, 660

[1] Finished fluorspar only.
[2] In addition, importers held 11,000 tons in 1949 (none in 1940–48).

The average composite selling price ($33.19 a short ton) of all grades of fluorspar (both domestic and foreign) delivered to consumers in the United States in 1949 was $1.05 more than in 1948.

The total quantity of fluorspar shipped from mines and imported into the United States from about 1870 through 1949 was approximately 9,141,000 short tons, comprising about 82 percent from domestic mines and 18 percent from foreign sources.

PRODUCTION AND SHIPMENTS

Production of finished fluorspar totaled 236,400 short tons in 1949, including 111,247 tons of flotation concentrates; in addition, crude ore equivalent to about 9,200 tons of finished fluorspar was mined but not milled in 1949. Thus, total production (expressed in terms of finished fluorspar) was 245,600 tons in 1949, compared with 333,900 tons in 1948. Of the mine output in 1949, 5 mines (producing over 10,000 tons each) supplied 60,800 tons, or 25 percent; 11 mines (producing 5,000 to 10,000 tons each) supplied 74,500 tons, or 30 percent; 32 mines (producing 1,000 to 5,000 tons each) supplied 86,500 tons, or 35 percent; and 7 mines (producing 500 to 1,000 tons each) supplied 4,900 tons, or 2 percent. Thus, 55 mines produced 226,700 tons, or 92 percent of the total. Of the remaining output (18,900 tons, or 8 percent), some (in quantities ranging from a few tons to 500 tons) came from an undetermined number of small mines and prospects, but much was derived from treated tailings from previous milling operations.

In 1949, mines operated by consumers produced 61,900 tons of finished fluorspar, compared with 89,600 tons in 1948.

Fluorspar shipments from domestic mines in 1949 aggregated 236,704 short tons valued at $8,266,754, decreases of 29 percent in quantity and 26 percent in value from 1948. Of the 1949 total, 53,243 tons were shipped by river or river-rail for delivery to consumers, compared with 71,696 tons in 1948.

Illinois (51 percent) and Kentucky (27 percent) supplied 78 percent of the fluorspar shipped in 1949, as in 1948. Shipments from Illinois and Kentucky were 28 percent less than in 1948, compared with a loss of 29 percent from other producing States.

The average value of all grades of domestic finished fluorspar shipped in 1949 ($34.92) established a new peak and was $1.08 more than the previous high of 1948.

Fluorspar shipments in 1949 comprised 121,163 tons of fluxing gravel (including 6,948 tons of flotation concentrates, which were

Fluorspar shipped from mines in the United States, by States, 1948–49

State	1948			1949		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Colorado	27,698	$831,218	$30.01	22,324	$763,296	$34.19
Illinois	172,561	6,322,246	36.64	120,881	4,621,733	38.23
Kentucky	84,889	2,663,377	31.37	63,438	2,018,209	31.81
New Mexico	24,968	911,682	36.51	12,844	446,086	34.73
Utah	9,523	195,338	20.51	8,332	180,166	21.62
Other States:						
Arizona	1,271	303,591	25.07	846	237,264	26.70
Montana	318			422		
Nevada	9,615			5,847		
Texas	906			1,770		
Total	331,749	11,227,452	33.84	236,704	8,266,754	34.92

Fluorspar shipped [1] from mines in the United States, by States, 1945–49, with shipments of maximum year and cumulative shipments from earliest record to end of 1949, in short tons [2]

State	Maximum shipments		Shipments by years						Total shipments [1] from earliest record to end of 1949	
							1949			
	Year	Short tons	1945	1946	1947	1948	Short tons	Percent of total	Short tons	Percent of total
Arizona	1939	1,698	1,126	389	1,891	1,271	846	0.4	16,142	0.2
California	1934	181							341	(3)
Colorado [4]	1944	65,209	52,437	32,530	33,153	27,698	22,324	9.4	558,128	7.4
Illinois [4]	1943	198,789	147,251	154,525	167,157	172,561	120,881	51.1	3,989,555	53.0
Kentucky [4]	1941	142,862	95,142	63,142	90,256	84,889	63,438	26.8	2,514,340	33.4
Montana	1949	422				318	422	.2	740	(3)
Nevada	1948	9,615	7,036	6,234	8,042	9,615	5,847	2.5	92,949	1.2
New Hampshire	1917	1,274							8,302	.1
New Mexico	1944	42,973	14,449	17,384	27,536	24,968	12,844	5.4	300,997	4.0
Tennessee	1906	380							1,197	(3)
Texas	1944	4,769	2,412	1,118	1,019	906	1,770	.7	14,060	.2
Utah	1948	9,523	2,973	2,370	1,736	9,523	8,332	3.5	33,323	.5
Washington	1945	132	132	38					382	(3)
Wyoming	1944	19							19	(3)
Total	1944	413,781	320,961	297,940	339,494	331,749	236,704	100.0	7,528,475	100.0

[1] Figures for 1880–1906 represent production.
[2] Quantity and value figures, by States, for 1880–1925 in Mineral Resources, 1925, pt. 2, pp. 12–14, and for 1910–40 in Minerals Yearbook, Review of 1940, p. 1287.
[3] Less than 0.1 percent.
[4] Figures on production not recorded for Colorado before 1905, for Illinois before 1880, and for Kentucky before 1896 and for 1898–99. Total unrecorded production (estimated) included in "Total shipments" column as follows: Colorado, 4,400 tons; Illinois, 20,000 tons; and Kentucky, 600 tons.

Fluorspar shipped from mines in the United States, by grades and industries, 1948–49, in short tons

Grade and industry	1948	1949	Grade and industry	1948	1949
Fluxing gravel and foundry lump:			Acid lump: Nonferrous	1	1
Ferrous	[1] 167,733	[1] 115,242	All grades:		
Nonferrous	1,286	789	Ferrous	179,447	124,736
Cement	950	572	Nonferrous	2,380	2,038
Miscellaneous	4,780	4,560	Cement	950	572
Total	[1] 174,749	[1] 121,163	Glass and enamel	45,375	32,352
Ground and flotation concentrates:			Hydrofluoric acid	96,848	70,759
Ferrous [2]	[1] 11,714	[1] 9,494	Miscellaneous	6,105	5,464
Nonferrous	[2] 1,093	1,248	Exported	644	783
Glass and enamel	45,375	32,352	Grand total	331,749	236,704
Hydrofluoric acid	96,848	70,759			
Miscellaneous	1,325	904			
Exported	644	783			
Total	[1] 156,999	[1] 115,540			

[1] Fluxing gravel includes (and flotation concentrates exclude) the following quantities of flotation concentrates blended with fluxing gravel: 1948, 16,666 tons; 1949, 6,948 tons.
[2] Includes pelletized gravel.

blended with fluxing gravel) and foundry lump, 115,540 tons of ground and flotation concentrates, and 1 ton of acid lump. The bulk of the fluxing-gravel and foundry-lump fluorspar was shipped to steel plants and iron foundries, but a comparatively small tonnage moved to plants making cement, ferro-alloys, nickel, basic refractories, and fluxing compounds and to smelters of secondary metals. Of the ground and flotation concentrates shipped in 1949, hydrofluoric-acid plants took 61 percent and glass and enamel plants 28 percent; the remainder went chiefly to aluminum- and magnesium-reduction works; to manufacturers of steel, ferro-alloys, and welding rods; and to smelters of secondary metals.

SHIPMENTS, BY USES

As is evident from the accompanying table and figure 1, the predominant purchaser of fluorspar is the steel industry, which also consumes substantial quantities of hydrofluoric acid and sodium fluoride, for which fluorspar is the basic material.

Fluorspar shipped from mines in the United States, by uses, 1948–49

Use	1948				1949			
	Quantity		Value		Quantity		Value	
	Percent of total	Short tons	Total	Average	Percent of total	Short tons	Total	Average
Steel	51.4	170,633	$5,058,866	$29.65	50.4	119,264	$3,555,743	$29.81
Iron foundry	2.0	6,667	220,512	33.08	1.3	3,103	103,061	33.21
Glass	10.9	35,960	1,294,211	35.99	11.7	27,727	1,043,512	37.64
Enamel	2.8	9,415	362,111	38.46	2.0	4,625	186,312	40.28
Hydrofluoric acid	29.2	96,848	3,852,678	39.78	29.9	70,759	2,991,166	42.27
Miscellaneous	3.5	11,562	414,255	35.77	4.4	10,443	354,439	33.94
Exported	.2	644	24,819	38.54	.3	783	32,521	41.53
Total	100.0	331,749	11,227,452	33.84	100.0	236,704	8,266,754	34.92

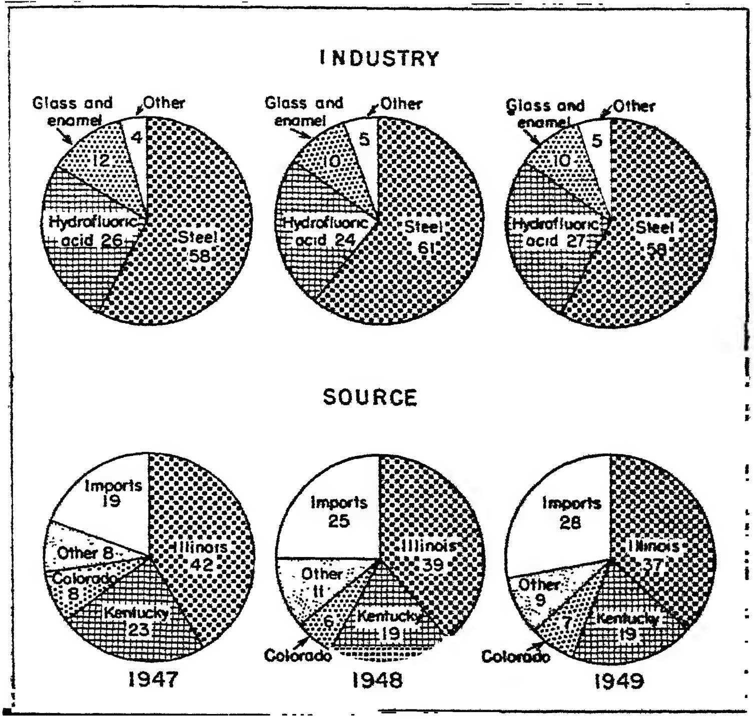

FIGURE 1.—Fluorspar sales (domestic and foreign) to consumers in the United States, 1947–49, by consuming industries and sources, in percent.

STOCKS AT MINES

According to the reports of producers, the quantity of fluorspar in stock at mines or shipping points at the close of 1949 totaled 121,516 tons, or 21 percent more than in 1948. These stocks comprised 37,039 tons of finished fluorspar and 84,477 tons of crude fluorspar (calculated to be equivalent to 36,000 tons of finished fluorspar).

Stocks of fluorspar at mines or shipping points in the United States, by States, at end of year, 1947–49, in short tons [1]

State	1947		1948		1949	
	Crude [2]	Finished	Crude [2]	Finished	Crude [2]	Finished
Colorado	7,135	674	6,498	737	7,986	551
Illinois	23,545	15,313	34,000	12,580	36,684	9,903
Kentucky	8,266	16,535	13,935	23,433	15,313	25,409
Nevada		41		383		317
New Mexico	19,186	386	6,046	312	21,186	440
Texas		103	180	2	400	70
Utah		49		49		80
Total	[3] 58,132	33,101	[3] 62,742	37,244	84,477	37,039

[1] Stocks reported for California and Idaho for 1947–48 have been dropped from the record.
[2] This crude (run-of-mine) fluorspar must be beneficiated before it can be marketed.
[3] Revised figure.

CONSUMPTION AND CONSUMERS' STOCKS

The accompanying tables give data on consumption and consumers' stocks of fluorspar.

Fluorspar (domestic and foreign) consumed and in stock in the United States, by industries, 1948–49, in short tons

Industry	1948			1949		
	Consumption	Stocks at consumers' plants Dec. 31	In transit to consumers' plants Dec. 31	Consumption	Stocks at consumers' plants Dec. 31	In transit to consumers' plants Dec. 31
Basic open-hearth steel	207,342			183,045		
Electric-furnace steel	25,241	111,260	8,589	18,278	100,591	3,948
Bessemer steel	104			178		
Iron foundry	6,209	2,161	5	4,956	1,745	63
Ferro-alloys	2,608	801		2,860	808	
Hydrofluoric acid [1]	107,280	19,530	297	89,152	17,138	149
Primary aluminum [2]	1,156	605		950	813	
Primary magnesium						
Glass	37,247	6,734	759	30,797	5,553	879
Enamel	8,871	1,987	373	5,510	1,277	65
Cement	1,078	1,152		848	875	
Miscellaneous	9,133	2,639	111	8,647	1,821	72
Total	406,269	146,869	10,134	345,221	130,621	5,176

[1] Fluorspar used in making artificial cryolite and aluminum fluoride (aluminum raw materials) is included in the figures for hydrofluoric acid, which is an intermediate in their manufacture.
[2] Figures on consumption represent fluorspar used as a flux; see footnote 1.

Production of basic open-hearth steel and consumption and stocks of fluorspar (domestic and foreign) at basic open-hearth steel plants, 1945–49

	1945	1946	1947	1948	1949
Production of basic open-hearth steel ingots and castings .... long tons	64,510,000	54,034,000	68,506,000	70,830,000	62,634,000
Consumption of fluorspar in basic open-hearth steel production .... short tons	176,488	145,631	189,773	207,342	183,045
Consumption of fluorspar per long ton of basic open-hearth steel made .... pounds	5.5	5.4	5.5	5.9	5.8
Stocks of fluorspar at basic open-hearth steel plants at end of year .... short tons	63,900	61,600	68,400	106,300	97,400

Fluorspar was reported consumed in 39 States and the District of Columbia in 1949, but 3 States—Illinois, Ohio, and Pennsylvania—used 182,969 tons, or 53 percent of the total consumption. Pennsylvania was again the chief consuming State; it ranked first in consumption of fluorspar both in steel and glass and sixth in the manufacture of hydrofluoric acid. Illinois maintained its rank as the largest consumer of fluorspar in hydrofluoric acid in 1949.

The accompanying table shows, so far as possible without revealing the figures of individual companies, the consumption of fluorspar by States in 1948 and 1949.

Fluorspar (domestic and foreign) consumed in the United States, by States, 1948–49, in short tons

State	1948	1949
Alabama, Georgia	12,435	10,517
Arkansas, Louisiana, Mississippi, North Carolina, South Carolina, Florida	17,269	22,457
California	10,612	10,050
Colorado, Iowa, Utah	15,308	14,578
Connecticut	950	662
Delaware, District of Columbia, New Jersey	26,984	24,380
Illinois	63,304	54,452
Indiana	30,077	24,250
Kansas, Nebraska, South Dakota, Wyoming	272	265
Kentucky	7,483 (with Maryland)	5,319
Maryland		6,082
Maine, Massachusetts, Rhode Island	1,503	1,188
Michigan	9,994	10,191
Minnesota, Wisconsin	3,870	3,918
Missouri	4,041	2,790
New York	14,588	12,808
Ohio	67,725	56,451
Oklahoma	900	1,048
Oregon, Washington	2,358	1,965
Pennsylvania	97,664	72,066
Tennessee	1,084	389
Texas	12,387	5,296
Virginia	61	78
West Virginia	5,400	4,022
Total	406,269	345,221

REVIEW BY STATES

Alabama.—The Gilley fluorspar deposits in Cherokee County, Ala., have been examined and a report [1] issued.

Arizona.—Production of fluorspar in Arizona was 846 short tons in 1949, compared with 1,271 tons in 1948. The 1949 output came chiefly from Cochise County, but some came from Pima and Maricopa Counties. The fluorspar from Cochise County was from the Lone Star mine operated by Cooper Shapley, Jr., and that from Pima County was from the Mary Jane mine operated by Ira L. Moseley; the fluorspar from these mines was shipped to steel plants and to plants making ferro-alloys and special flux. The fluorspar from Maricopa County was from the Mammoth and surrounding veins operated by J. A. Campbell, the West End Spar mine operated by Isaac Campbell, and a property operated by Raymond Contreras; the fluorspar from these properties was shipped to steel plants. The Snowball fluorspar deposit in Maricopa County has been discussed.[2]

California.—The Industrial Minerals & Chemical Co., West Berkeley, Calif., ground some Nevada fluorspar, which it sold chiefly to local dealers; a small quantity was exported. The company also ground some Nevada fluorspar on a toll basis for Balfour, Guthrie & Co., Ltd., and sold it to an enamel plant.

Colorado.—Production of finished fluorspar in Colorado decreased to 22,400 short tons in 1949 from 27,800 tons in 1948. In addition, about 1,500 tons of crude ore equivalent to 600 tons of finished

[1] O'Neill, J. F., Investigation of Gilley Fluorspar Deposits, Cherokee County, Ala.: Bureau of Mines Rept. of Investigations 4665, 1950, 6 pp.

[2] Denton, T. C., and Kumke, C. A., Investigation of Snowball Fluorite Deposit, Maricopa County, Ariz.: Bureau of Mines Rept. of Investigations 4546, 1949, 13 pp.

fluorspar was mined but not milled in 1949. Thus, production (expressed in terms of finished fluorspar) totaled 23,000 tons in 1949, compared with 27,100 tons in 1948. Output in 1949 came from Boulder, Chaffee, and Mineral Counties.

Shipments of fluorspar from Colorado in 1949 declined for the fifth consecutive year and were the smallest since 1941; they were 22,324 tons, compared with 27,698 tons in 1948. The 1949 shipments comprised 16,998 tons of flotation concentrates and 5,326 tons of fluxing-gravel fluorspar.

The Ozark-Mahoning Co., operating a flotation mill near Jamestown, produced 3 percent more flotation concentrates in 1949 than in 1948, despite the fact that the flotation mill was inactive about 2 months because of a strike at a consumer's plant. The flotation-mill feed comprised ore chiefly from the Argo mine, but some was also contributed by the Afterthought, Blue Jay, and Emmett mines. These mines are in Boulder County and were operated by Harry M. Williamson & Son.

The flotation mill of the General Chemical Division, Allied Chemical & Dye Corp., near Jamestown, produced 24 percent less concentrates than in 1948. The flotation-mill feed comprised ore chiefly from the company-operated Burlington mine, but a small tonnage came from its Yellow Girl mine, both in Boulder County. A small quantity was purchased from other Boulder County mines.

Fluorspar, Inc., operated the flotation mill near Salida of the bankrupt United States Fluorspar, Inc., until August 6, when production was discontinued because of the poor condition of the mill and consequent high cost. The flotation-mill feed came from the Aksarben mine, also near Salida, in Chaffee County. The company was building a new mill.

J. H. & E. Lionelle produced a small tonnage of fluorspar from a property in Chaffee County in 1949; it was shipped to the local steel plant.

The Wagon Wheel Gap mine of the Colorado Fuel & Iron Corp. in Mineral County produced 43 percent less fluxing-gravel fluorspar in 1949 than in 1948. Much of the 1949 fluorspar requirements of the company steel plant at Pueblo was obtained from Mexico and from producers in Colorado and New Mexico.

Results of an investigation of the fluorspar deposits in Boulder County have been described.[3]

Illinois.—Illinois maintained its premier position as a fluorspar-producing State. Production of finished fluorspar was 118,300 short tons in 1949; about 90 percent came from Hardin County and the remainder from Pope County. In addition, some crude ore equivalent to 1,400 tons of finished fluorspar was mined but not milled in 1949. Thus, total mine production (expressed in terms of finished fluorspar) was 119,700 tons in 1949, compared with 172,700 tons in 1948. Some Kentucky fluorspar is milled in Illinois, and some Illinois fluorspar is milled in Kentucky; the finished fluorspar so recovered, as well as that shipped, is credited in the statistics to the State of origin. The Argo, Austin, Blue Diggings, Crystal, Deardorff, Douglas, East Green, Empire, Fairview, Geely Shaft, Interstate,

[3] Hild, J. H., and Ames, E. W., Investigation of Jamestown Fluorite Deposits, Boulder County, Colo.: Bureau of Mines Rept. of Investigations 4483, 1949, 10 pp.

Jefferson, Knox, Mahoning Shaft No. 2, Mahoning Shaft No. 5, Midway-North Boundary-Air Shaft-Hillside, Minerva, Pell Shaft, Redd, Rosiclare, South Boundary-Recovery Shaft, Victory, and West Green properties supplied about 97 percent of the fluorspar produced in Illinois in 1949. Most of the remainder came from many mines and prospects, chiefly the Baker, Big Creek, Hawkins Shaft, Humm, Lead Hill, Mahoning Shaft No. 4, Rose Creek, and Twitchell; some was recovered from tailings from previous milling operations.

Shipments of fluorspar from Illinois (120,881 tons) were 30 percent less than in 1948 and contributed 51 percent of the total domestic shipped. The 1949 shipments were the smallest since 1940. Of the 1949 total, 29,742 tons were shipped by river or river-rail to consumers, compared with 50,441 tons in 1948.

The Alcoa Mining Co. produced 25 percent less flotation concentrates in 1949 than in 1948. The mill feed comprised ore from the company-operated Argo, Blue Diggings, and Fairview mines. The ore from these mines is first treated in the company heavy-medium unit, which supplies an enriched product for flotation feed. The Argo-Blue Diggings vein system was worked through the Blue Diggings and Fairview shafts on the 300-, 400-, 500-, 600-, 700-, 800-, and 900-foot levels. A crosscut was driven from the 800-foot level to the bottom of the Fairview shaft, and a 75,000-gallon sump and pumping station were installed on the 800-foot level. Water from the Fairview shaft area is pumped to the 700-foot level, where it flows to the main pumping station at the Blue Diggings shaft. The company prospected by diamond drilling the Ruie Robinson property, but no fluorspar was disclosed.

The Crystal Fluorspar Co. produced 40 percent less finished fluorspar in 1949 than in 1948. Production in 1949 was obtained from the Crystal and Jefferson mines. At the Jefferson mine the sinking of a 100-foot winze from the 260-foot level was begun in December 1949.

The Ozark-Mahoning Co. produced 26 percent less fluorspar flotation concentrates in 1949 than in 1948. The mill feed in 1949 comprised ore from the Deardorff, East Green, Mahoning Shafts Nos. 2, 4, and 5, North Green, and West Green mines near Cave in Rock, Ill., the Delhi-Babb and Goering mines near Salem, Ky., and the Commodore mine near Marion, Ky., and some purchased ore, chiefly from the Mineral Ridge mine also near Salem. Production of finished fluorspar in 1949 comprised 81.9 percent acid grade, 16.7 percent pelletized gravel, and 1.4 percent filter cake; the filter cake was sold to local producers for blending with fluxing gravel. Production and shipments of finished fluorspar from the Delhi-Babb, Commodore, Goering, and Mineral Ridge mines have been credited to Kentucky in the statistics. The Ozark-Mahoning Co. was the largest producer of fluorspar in the United States in 1949. The company started sinking a 365-foot shaft on the Ida Oxford tract near Cave in Rock, Ill.

The Rosiclare Lead & Fluorspar Mining Co. operated the Eureka, Geely, Hawkins, Interstate, Midway-North Boundary-Air Shaft-Hillside, Pell, Rosiclare, and South Boundary-Recovery properties in 1949, but the Rosiclare was again the chief producing mine of the company. The company also purchased some fluorspar from local

producers. The ore from the company mines is mill feed for its heavy-medium, jig, and flotation mills. Production of finished fluorspar of all grades was 37 percent less than in 1948, and shipments were 28 percent smaller. The Rosiclare mine was allowed to flood to permit experimental pressure grouting in an effort to shut off a flow of underground water into the mine at a rate of 7,000 gallons per minute. An 1,800-gallon-per-minute, 660-foot head, deep-well type pump was installed in the Rosiclare shaft.

Operations at the mine and flotation mill of Minerva Oil Co. were at reduced rates during the first 9 months of 1949. As a result of increased demand during the last quarter of 1949, the mine and mill were operated on a 5-day and a 6-day week basis, respectively. Output of flotation concentrates was 27 percent smaller than in 1948, but sales were down 32 percent. The company continued prospecting with two to three drills on or near owned properties. Roof-bolting replaced most timbering in the mine. The company resumed sinking a 580-foot escape and service shaft. The mining practice at the Minerva mine has been described.[4]

Production in 1949 at the Douglas mine in Pope County, operated by the P. M. T. Mining Co., was 11 percent less than in 1948. The Redd mine operated by the Redd Mining Co. and Humm & Partain and the Empire mine operated by Egyptian Mining Co., J. P. & G. Mining Co., and G. & B. Mining Co.—both also in Pope County—and the Knox mine operated by Knox Spar Co., Rose Hill mine operated by Yingling Mining Co., Baker mine operated by Golconda Illinois Mining Co., Inc., Humm mine operated by C. C. Mackey, and Austin mine operated by A. B. C. Mining Co. and Blue Valley Mining Co.—all in Hardin County—were the largest of the many smaller mines worked in Illinois in 1949.

Results of an investigation of a deposit in Pope County have been described.[5]

Kentucky.—Production of finished fluorspar in Kentucky in 1949 (65,500 short tons) was 29 percent less than in 1948 and also 29 percent under the average for the 5 years 1944–48. Total mine production (expressed in terms of finished fluorspar) was 64,800 tons in 1949, compared with 93,500 tons in 1948. Shipments also were less; they were 63,438 tons—a 25-percent decline from 1948. Of the 1949 shipments, 23,501 tons were shipped by river or river-rail, compared with 21,255 tons in 1948.

Reflecting the inactivity at the Hughett mine, which was an important producer in 1948, output in Caldwell County in 1949 was only 400 short tons, compared with 5,200 tons in 1948.

The major part of the 1949 output in Crittenden County came from the Blue, Commodore, Delhi-Babb, Keystone, Pigmy, Tabb No. 1, and Yandell No. 22 mines. Most of the remainder came from many smaller producing mines, including the Hickory Cane, Holly, Krausse, Mary Belle, Pogue, Reiter, and Watkins; and some was recovered from tailings from previous milling operations.

Production of fluorspar in 1949 by the United States Coal & Coke Co., the largest producer in Kentucky, was virtually the same as in

[4] Needham, A. B., Methods and Costs of Mining Fluorspar from a Flat-Bedded Deposit at Cave in Rock, Ill.: Bureau of Mines Inf. Circ. 7514, 1949, 10 pp.

[5] Bishop, O. M., and Needham, A. B., Investigation of Douglas Fluorite Property, Pope County, Ill.: Bureau of Mines Rept. of Investigations 4424, 1949, 13 pp.

1948, but shipments were 16 percent larger. Output came from the Tabb No. 1 and Yandell No. 22 mines.

The Kentucky Fluor Spar Co. and affiliates shipped 13 percent less fluorspar and "fluorbarite" than in 1948. The company operates a mill at Marion and, through its mining division (Roberts & Frazer), operated the Carr and Wright mines in Livingston County. Only about one-third of the supply came from company mines in 1949; most of it was supplied by the Austin, Blue, Empire, Knox, Krausse, Lead Hill, and Redd mines and the flotation mills of Crider Bros. Fluorspar Co. and Minerva Oil Co.

The Keystone mine and heavy-medium mill of Inland Steel Co. were operated throughout 1949. Output of ore at the Keystone mine was 32 percent less than in 1948, and production at its heavy-medium mill was 30 percent smaller. However, shipments of fluorspar by Inland Steel Co. were 8 percent greater than in 1948.

Output of fluorspar at the Pigmy mine of the Pigmy Corp. (subsidiary of the Rosiclare Lead & Fluorspar Mining Co.) declined for the fifth consecutive year and was 38 percent less in 1949 than in 1948. Much development was in progress at the Pigmy mine in 1949.

Except for a small quantity of fluorspar produced at the Hickory Cane mine, virtually all of the supply of Delhi Fluorspar Corp. in 1949 was purchased from local producers and from Mexico; the Mexican fluorspar was blended with domestic fluorspar. The domestic fluorspar came chiefly from the Austin, Douglas, Knox, and Redd mines in Illinois. The Mexican fluorspar so blended and shipped has not been included in the statistics for Kentucky. Total shipments by Delhi Fluorspar Corp. were 35 percent less than in 1948. The company completed a barge-loading station equipped with a conveyor 62 feet long on the Kentucky side of the Ohio River opposite Cave in Rock, Ill.

L. Conyer shipped 73 percent less fluorspar in 1949 than in 1948. He operates a jig mill near Marion and depends on purchases of local ore and tailings for his supply. Most of it was obtained from the Baker, Redd, and Twitchell mines in Illinois and the Mary Belle mine in Kentucky.

Ben E. Clement, who also depends on purchased fluorspar from local mines and Mexico, sold 74 percent less fluorspar than in 1948. The Mexican fluorspar, which was used to raise the grade of locally purchased fluorspar, has not been included in the statistics for Kentucky.

Crider Bros. Fluorspar Co. worked the Blue mine near Mexico, Ky., reclaimed some fluorspar from the Haffaw and Blue dumps, and purchased fluorspar from local producers. The ore from the company mines is mill feed for its gravity-concentrating and flotation mills. Output in 1949 comprised 65 percent metallurgical-grade fluorspar and 35 percent flotation concentrates. Sales of fluorspar by the company were 50 percent smaller than in 1948.

The C & L Fluorspar Co. operated its flotation mill at Marion, but output of flotation concentrates was 28 percent less than in 1948. The mill feed comprised tailings from local mines. The company purchased much fluorspar from local mines which it blended with its flotation concentrates. Total sales were 60 percent less than in 1948.

The company Hughett mine in Caldwell County did not produce any fluorspar in 1949.

Davenport Mines, Inc., did not operate its Davenport and Hicks mines in 1949 because of installing electric pumps, hoists, and compressors. Meanwhile, however, its heavy-medium mill was operated on ore purchased locally and on ore recovered from dumps that had accumulated for many years.

The Alcoa Mining Co. did not operate any fluorspar mines in Kentucky in 1949, but its Mary Belle mine was leased to and operated by F. B. Moodie, Jr. However, the company did prospect core drilling on the Blue & Marble, Catiller "A" and "B," Gardner-Edmonds, Klondike, Trabue-Skelton, and Wadley properties, and as a result it purchased the Klondike in Livingston County and the Blue & Marble in Crittenden County. Fluorspar and zinc were discovered by diamond drilling on the company-owned Trabue-Skelton property.

In Livingston County, production of finished fluorspar declined to 7,500 tons in 1949 from 9,800 tons in 1948. The output in 1949 came chiefly from the Carr, May, and Mineral Ridge mines and from reworking the Klondike tailings.

Output at the Carr and Wright mines of Roberts & Frazer was virtually the same in 1949 as in 1948.

The Mineral Ridge mine, operated by Alco Lead Corp., produced 22 percent less ore in 1949 than in 1948; its output was shipped to the flotation mill at Rosiclare, Ill., of Ozark-Mahoning Co.

Butler & Moodie continued to reclaim fluorspar from Klondike tailings at its flotation mill near Mullikin.

A report [6] on the Klondike mine has been published.

In the Central Kentucky district, Hageman Properties, Inc., discontinued mining of fluorspar in April, and as a consequence production and shipments declined substantially in 1949. Most of the ore produced in 1949 was shipped to Marion, Ky., where it was treated in the heavy-medium mill of Kentucky Fluor Spar Co.

Montana.—Production of fluorspar in Montana was 422 short tons in 1949, compared with 318 tons in 1948. The output in both years came from the property of Coeur d'Alene Extension Mines, Inc., in Mineral County near Superior. The Riverside Copper Mining Co., Wallace, Idaho, subleased a group of mining claims in this area.

Nevada.—Shipments of fluorspar from Nevada were 5,847 short tons in 1949, a decline of 39 percent from the record year 1948 and the smallest since 1940. Most of the 1949 output went to steel plants; but some was shipped to cement, ferro-alloy, glass, and enamel plants and iron foundries, and a little was exported. The fluorspar moving to glass and enamel plants and exported was ground by Industrial Minerals & Chemical Co., West Berkeley, Calif.

The chief producing mine in Nevada in 1949 was the Daisy, in Nye County, operated by J. Irving Crowell, Jr.; its production was 28 percent less than in 1948. The Baxter mine in Mineral County, operated by V. S. Baxter, was the second-largest producing mine in Nevada in 1949; its output, however, declined 63 percent from 1948. Three cars of fluorspar were produced at the Cirac Revenue Group in Churchill County by C. P. Cirac in 1949.

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[6] Swanson, A. S., Investigation of the Klondike Fluorspar Deposit, Livingston County, Ky.: Bureau of Mines Rept. of Investigations 4603, 1949, 19 pp.

New Mexico.—Production of finished fluorspar in New Mexico was 13,000 short tons in 1949, a decline of 48 percent from 1948. In addition, about 15,000 tons of crude ore equivalent to 7,800 tons of finished fluorspar was mined but not milled in 1949. Thus, total mine production (expressed in terms of finished fluorspar) was 20,800 tons in 1949, compared with 18,700 tons in 1948. The 1949 output came from Dona Ana, Grant, Lincoln, Luna, Rio Arriba, Sierra, and Valencia Counties. The Zuñi mines in Valencia County, Purple Heart and Shrine mines in Grant County, and Greenleaf and White Eagle mines in Luna County supplied about 67 percent of the fluorspar produced in New Mexico in 1949. Most of the remainder came from many mines and prospects and from tailings from previous milling operations.

Shipments of fluorspar from New Mexico totaled 12,844 tons in 1949, a loss of 49 percent from 1948. The 1949 shipments were the smallest since 1940.

The flotation mill of General Chemical Division, Allied Chemical & Dye Corp., at Deming, produced 13 percent less concentrates in 1949 than in 1948. The mill feed comprised ore from the company-operated Shrine mine in Grant County, purchased ore from local mines—chiefly the Greenleaf and White Eagle mines in Luna County and the Purple Heart mine in Grant County—and tailings from the Gila mill.

The flotation mill of Zuñi Milling Co., at Los Lunas, produced 78 percent less concentrates than in 1948. The mill feed comprised ore chiefly from the company mines near Grants in Valencia County, but a comparatively small quantity of ore was purchased from local mines. Two inclined shafts—one equipped with a skip and a hoist and the other with a belt conveyor—have been completed at the company No. 21 mine.

H. E. McCray operated the Greenleaf and Greenleaf No. 2 mines in Luna County near Deming and purchased fluorspar from the Gratton, Greenspar, Nakaye, and Valley properties in 1949.

Work was continued at the Burro Chief fluorspar property near Tyrone, Grant County, by Phelps Dodge Corp. to determine the possibility of resumption by the corporation of operations formerly carried on by leasers. According to the corporation, the results are inconclusive though not without some promise.

Tennessee.—According to the Tennessee Valley Authority:[7]

A plant-scale demonstration unit for the recovery of fluorine, which is liberated in one form or another in most phosphate-manufacturing processes, was placed in operation at the fused tricalcium phosphate plant toward the end of the year. The process, a relatively simple one in which waste gases from the furnaces are passed through a tower packed with lump limestone, was tested in pilot-plant operation last year. The fluorine is recovered as calcium fluoride, which promises to be a salable byproduct in view of the expanded demand for fluorine compounds.

Charles H. Young, Director, Division of Chemical Engineering, Tennessee Valley Authority, states:[8]

Since the byproduct calcium fluoride produced by the Tennessee Valley Authority thus far has been incidental to the development of the fused tricalcium phosphate fertilizer process, the quality of the byproduct has been erratic. For this reason, the amounts produced have been discarded. Present indications are

[7] Annual Report of the Tennessee Valley Authority for the fiscal year ended June 30, 1949, p. [illegible].
[8] Letter to Bureau of Mines, Mar. 28, 1950.

that the grade of the byproduct will soon become stabilized within the range 80 to 85 percent CaF_2, at which time we propose to undertake the sale of the byproduct.

Texas.—Production of finished fluorspar in Texas was 1,838 short tons in 1949, a gain of 128 percent over 1948; shipments (1,770 tons) were 95 percent larger. Production was from the Eagle Mountains mine in Hudspeth County near Van Horn, operated by the Texas Fluorspar Mines, Inc. Production was suspended during August and September because of a strike at a consumer's plant. A new 600-foot water well with substantial flow was brought in during the first quarter of 1949, thus relieving water shortage for milling. The principal production of ore was from mine No. 4, where sinking to a new working level was in progress at the year end. Preliminary work was going forward at the Fox mine, which will provide a good crude-ore source for 1950.

Utah.—Production of fluorspar in Utah was 8,372 short tons in 1949, a decline of 12 percent from the record high in 1948. However, output in 1949 was the second highest. The bulk of the production came from Juab County near Delta, where George Spor & Sons, Chesley & Black, Willden Bros., and Ward Leasing Co. operated intermittently. All of the fluorspar produced was shipped to the steel plant at Geneva. A car of fluorspar was shipped from a property in Beaver County by Fred Staats, and a car was also shipped from a property in Piute County by Bullion Monarch Mining Co.

MILLING

Output of flotation concentrates from domestic ore totaled 111,247 short tons in 1949, compared with 156,246 tons in 1948. In addition, 33 tons of flotation concentrates were recovered from milling 43 tons of Mexican ore at a plant in the United States.

The Crystal Fluorspar Co., Elizabethtown, Ill., completed a heavy-medium separation mill with a seven-foot cone at its Crystal mine to serve it and its Jefferson mine; the new plant began operating August 8. The new mill replaces a jig plant, which was dismantled.

The Texas Fluorspar Mines, Inc., Van Horn, Tex., added a 5-foot by 4-foot ball mill to its flotation plant, which was overhauled.

Fluorspar, Inc., Salida, Colo., was building a new flotation mill to serve its Aksarben mine.

Two-stage ball milling and triple classification were placed in operation in December in the flotation plant of Minerva Oil Co., Cave in Rock, Ill.

A new ball mill and ore-feeding equipment were added to the milling plant of Rosiclare Lead & Fluorspar Mining Co., Rosiclare, Ill.

Additional equipment was installed in the Rosiclare flotation mill of Ozark-Mahoning Co. to regrind and rehandle middlings from the fluorspar circuits.

The Inland Steel Co. installed a primary crusher and conveyor at its heavy-medium mill near Marion, Ky.

Davenport Mines, Inc., installed a finishing screen in its heavy-medium mill, which will double the head feed.

At its Rolla (Mo.) Branch the Bureau of Mines investigated the pelletization of fine metallurgical-grade fluorspar with various binders.

PRICES

Metallurgical-grade fluorspar containing 70 percent or more effective calcium fluoride content was quoted at $37 a short ton f. o. b. Illinois-Kentucky mines throughout 1949; this price has been in effect since Oct. 14, 1948. The quoted prices on other metallurgical grades of fluorspar remained unchanged at $36, $35, and $34 a ton. Effective January 1, 1949, the selling price of acid-grade fluorspar containing a minimum of 97 percent calcium fluoride was advanced to $45 a short ton f. o. b. Illinois mines; but on September 1 it was lowered to $43.50 a ton.

The average selling price of all grades of domestic fluorspar shipped in 1949 was $34.92 a short ton—a new peak—compared with $33.84 in 1948.

FOREIGN TRADE [9]

Imports.—Receipts of imported fluorspar into the United States were 95,619 short tons in 1949, a loss of 14 percent from the all-time high of 1948. Imports of fluorspar in 1949, however, were the third largest.

Fluorspar imported for consumption in the United States, which represents the quantity on which the duty was paid, likewise declined in 1949; they were also 95,619 tons, or 14 percent smaller than in 1948. The imports in 1949 comprised 20,490 tons containing more than 97 percent calcium fluoride and 75,129 tons of lower grade. They were valued [10] at $1,549,044. The value assigned to the higher-grade fluorspar averaged $24.07 a ton in 1949 and that to the lower grade

Fluorspar imported for consumption in the United States in 1949, by countries and customs districts

[U. S. Department of Commerce]

Country and customs district	Containing more than 97 percent calcium fluoride		Containing not more than 97 percent calcium fluoride		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
France: Philadelphia			1,522	$27,990	1,522	[illegible]
Italy: Philadelphia	2,239	$71,631	5,618	58,731	7,857	130,362
Mexico:						
Arizona	193	2,657	18,215	152,675	18,408	155,332
Chicago			74	1,182	74	1,182
El Paso	27	287	7,454	72,911	7,481	73,198
Galveston			47	636	47	636
Laredo	2,700	56,936	37,314	539,918	40,014	596,854
San Diego			127	1,667	127	1,667
Total	2,927	59,880	55,331	766,021	58,258	826,001
Newfoundland: Philadelphia	15,344	361,633			15,344	361,633
Spain: Philadelphia			12,648	200,356	12,648	200,356
Total: 1949	20,490	493,134	75,129	1,055,910	95,619	1,549,044
1948	20,196	532,300	91,430	1,292,794	111,626	1,825,094

[9] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[10] As defined in sec. 402 of the Tariff Act of 1930: "The value of imported merchandise * * * is the foreign value or the export value, whichever is higher—that is, the market value or the price at which the merchandise, at the time of exportation to the United States, is offered for sale in the principal markets of the country from which exported, including the cost of containers or coverings and all expenses (including any export tax) incident to placing the [illegible] in condition ready for shipment to the United States."

$14.05. The cost to consumers in the United States also includes duty, loading charges, insurance, consular fee, and freight to consuming plants. The duty on fluorspar containing not more than 97 percent calcium fluoride continued at $5.625 a short ton and on fluorspar containing more than 97 percent calcium fluoride $3.75.

In 1949, 3,478 tons of Mexican fluorspar were blended with fluxing-gravel fluorspar from the Illinois-Kentucky district. The Mexican fluorspar so blended has been excluded from the statistics on shipments from mines in the United States and included in the figures on imports.

The following table, compiled from data supplied to the Bureau of Mines by importers and domestic companies milling foreign fluorspar, shows the quantities of imported fluorspar delivered to consumers in the United States in 1948 and 1949, irrespective of year of importation into the United States. The quantities are based upon the actual outturn weights and include the finished fluorspar recovered from milling and drying foreign ore, rather than the ore milled or concentrate dried.

Imported fluorspar delivered to consumers in the United States, 1948–49, by uses

Use	1948			1949		
	Short tons	Selling price at tidewater, border, or f. o. b. mill in the United States, including duty		Short tons	Selling price at tidewater, border, or f. o. b. mill in the United States, including duty	
		Total	Average		Total	Average
Steel	98,671	$2,458,384	$24.91	68,783	$1,667,252	$24.24
Hydrofluoric acid	10,008	468,861	46.84	16,020	735,182	45.89
Ferro-alloys	265	6,201	23.40	278	6,011	21.62
Glass and enamel	227	11,478	50.56	2,130	102,042	47.91
Other	2,059	69,033	33.53	2,648	69,040	26.07
Total	111,231	3,013,957	27.10	89,859	2,579,527	28.71

Exports.—Producers of fluorspar reported exports of 783 short tons of fluorspar valued at $32,521 in 1949, compared with 644 tons valued at $24,819 in 1948. The exports (all ceramic ground and flotation concentrates) by producers in 1949 comprised 753 tons to Canada, 20 tons to Pakistan, and 10 tons to Venezuela. In addition to the fluorspar exported by producers in 1949, dealers exported 12 tons to Brazil, 5 tons to Peru, 1 ton to Ecuador, 1 ton to Switzerland, and 1,100 pounds to Bolivia.

Fluorspar reported by producers as exported from the United States, 1944–49

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1944	1,980	$65,900	$33.29	1947	1,180	$43,679	$37.02
1945	1,420	45,929	32.35	1948	644	24,819	38.54
1946	1,728	63,797	36.92	1949	783	32,521	41.53

WORLD REVIEW

The accompanying table shows world production of fluorspar, by countries, 1943–49, insofar as statistics are available.

Australia.—The principal fluorspar-producing centers in Queensland are Fluorspar Siding, Mungana, Muldiva, and Alma Den.[11] Production has ranged from 361 to 887 metric tons during the 5-years 1945–49.

World production of fluorspar, by countries, 1943–49, in metric tons

[Compiled by Pauline Roberts]

Country [1]	1943		1945			1948	
Argentina (shipments)	1,713	2,674	3,012	2,133	2,400	(2)	(2)
Australia:							
Queensland	544	520	801	875	887	361	568
Victoria	468	266	145	326	332	159	-------
Bolivia (exports)	(2)	(2)	19	(2)	28	227	264
Brazil	-------	-------	-------	-------	841	751	537
Canada:							
Newfoundland (shipments)	56,478	44,912	25,300	23,366	36,191	47,833	50,417
Other Provinces	10,169	6,281	6,685	7,296	6,519	10,287	5,796
France	24,160	13,400	14,535	19,235	31,596	32,000	(2)
French Morocco	-------	-------	-------	-------	-------	-------	445
Germany:							
Bizonal	198,536	[3] 170,000	(2)	30,910	19,235	37,549	33,871
Soviet Zone				(2)	(2)	(2)	(2)
India	1,667	1,249	438	(2)	(2)	(2)	(2)
Italy	30,486	6,757	3,333	7,430	20,860	39,540	17,746
Japan	7,282	7,967	3,207	258	61	68	900
Korea:							
North	[4] 39,589	[4] 53,131	19,434	(2)	(2)	(2)	(2)
South				-------	-------	-------	1,230
Mexico (exports)	22,469	56,450	50,251	21,949	45,737	75,381	[3] 56,000
Norway	906	3,119	2,516	1,440	1,069	-------	(2)
Southern Rhodesia	297	-------	-------	-------	154	12	239
Spain	34,911	55,806	9,643	8,712	13,885	30,250	81,915
Sweden	2,107	1,836	3,448	3,722	2,780	4,303	(2)
Switzerland	562	520	-------	-------	-------	-------	-------
Tunisia	16	-------	-------	-------	-------	525	352
Union of South Africa	4,646	3,481	3,657	4,821	4,815	3,754	5,107
United Kingdom	56,186	46,927	44,281	47,200	45,016	71,134	(2)
United States (shipments)	368,330	375,374	203,891	263,142	298,901	300,956	214,733
Total (estimate)	1,037,000	1,006,000	477,000	567,000	670,000	796,000	689,000

[1] In addition to countries listed, China and U. S. S. R. produce fluorspar, but data of output are not available; estimates by author of chapter included in total.
[2] Data not available; estimates by author of chapter included in total.
[3] Estimate.
[4] Exports to Japan.

Canada.—According to the Dominion Bureau of Statistics, production of fluorspar in Ontario was 5,795 metric tons[12] in 1949, compared with 10,287 tons in 1948. According to information furnished to the U. S. Bureau of Mines by the two producers of fluorspar in Newfoundland, shipments were 50,417 metric tons in 1949, compared with 47,833 tons in 1948.

The St. Lawrence Corp. of Newfoundland, Ltd., has a gravity-concentrating mill and a flotation mill in Newfoundland for treating the ore from its several mines; and a subsidiary, St. Lawrence Fluorspar, Inc., has a plant at Wilmington, Del., for drying the flotation concentrate. Shipments by the St. Lawrence Corp. of Newfoundland, Ltd., and St. Lawrence Fluorspar, Inc., totaled 19,779 metric tons in 1949 (16,963 tons in 1948) and comprised 8,007 tons of fluxing gravel,

[11] Chemical Engineering and Mining Review (Melbourne), vol. 42, No. 1, Oct. 10, 1949, p. 17.
[12] 1 metric ton is equivalent to 1.10231 short tons.

1,574 tons of acid lump, and 10,198 tons of acid-grade flotation concentrate.

Newfoundland Fluorspar, Ltd., has two mines and ships crushed fluorspar principally to Arvida, Quebec, where the Aluminum Co. of Canada, Ltd., has a flotation plant. Shipments were 30,638 metric tons in 1949 (30,870 tons in 1948) and comprised 28,181 tons to Arvida and 2,457 tons to other customers. All of its 1949 production came from the 250-foot level of the Director mine, which was active throughout the year and where development continued. Its Tarefare mine was inactive throughout 1949.

Mexico.—Chiefly as a result of lessened demand in the United States—the principal market for Mexican fluorspar—production (as measured by exports) in Mexico was about 56,000 metric tons in 1949, a decrease of 26 percent from the record established in 1948. About 2,200 tons of Mexican fluorspar are used in local metallurgical plants, and some is exported to Canada.

Southern Rhodesia.[13]—Fluorspar has been mined on a small scale in the Wankie District, Southern Rhodesia, since 1938 and shipped to the steel plant of Bulawayo.

South-West Africa.—According to Chemical Age:[14]

> Important mining developments are taking place in the Otjiwarongo district of South-West Africa on behalf of the iron and steel corporation in Pretoria, Iscor. At Marburg Mountains there is an extremely large deposit of low-grade fluorspar which Iscor intends developing. The deposit, known for a long time, has hitherto not been economically workable. Iscor, however, will be able to use certain grades satisfactorily as a flux in steel processing. There is no immediate market for export fluorspar of these grades, but current investigations suggest that an export market may be secured.

During 1948, the Tsumeb Corp., in which the Newmont Mining Corp., New York, holds a 28½-percent interest, did geologic mapping, trenching, and diamond drilling on company claims at Okurusu, 90 miles southwest of Tsumeb. A description of the deposit was given in the chapter of this series for 1948 (pp. 543–544).

Spain.—Previous to World War II, Spain was a relatively small producer of fluorspar.. During the 27 years 1913–39 its average annual production was only about 3,800 metric tons. During World War II, however, chiefly as a result of demand by Germany and preclusive buying by the United States, production increased phenomenally from 9,097 tons in 1940 to a new high of 55,595 tons in 1944. The defeat of Germany and discontinuance of preclusive buying by the United States resulted in a spectacular drop in production to 8,712 tons in 1946. Since 1946, however, there has been renewed stimulation of development and production, and as a consequence output had increased to 61,915 tons in 1949. Inasmuch as consumption of fluorspar in Spain is small, the industry is largely dependent on the export market for its survival.

The chief producing mines in Spain are the Osor in the Gerona district, the Collada and Obdulia in the Asturias district, and the Fuenteovejuna in Cordoba Province. The Spanish fluorspar is relatively high grade, and simple washing and hand cobbing is generally ample to make metallurgical grade. The Osor mine is served by a flotation mill, which produces ceramic and acid grades of fluorspar.

[13] South African Mining and Engineering Journal, vol. 60, No. 2968, part II, Dec. 31, 1949, p. 595.
[14] Chemical Age (London), vol. 62, No. 1593, Jan. 21, 1950, p. 141.

Union of South Africa.[15]—Expansion of the steel industry in South Africa has resulted in greatly increased demand for local fluorspar and, consequently, virtually all production is now consumed in the Union, and exports are small. Virtually all output has come from Transvaal. Deposits in the Zeerust area were worked first in 1918, and peak output, all exported, of 10,975 metric tons was reached in 1923. Western Transvaal continued to be the major producer until 1936, when large deposits in Waterberg district began to be worked. Reserves in the Union have been estimated at 750,000 tons, most of which can be mined by open-pit methods.

United Kingdom.—The United Kingdom has shown much enterprise during and since World War II in developing its fluorspar industry and, as a result, output advanced from an average of 31,000 metric tons during the 10 years 1930–39 to 49,269 tons during the 9 years 1940–48; it reached a peak of 71,124 tons in 1948. Derbyshire and Durham are the chief producing centers.

According to the Mining Journal:[16]

> Present production is from old lead mines reopened for fluorspar working and from dumps. It is estimated that the United Kingdom reserves now amount to some 15 years' supply at a consumption rate of 65,000 tons. However, the recent introduction of flotation in dressing operations is a favorable factor.

CRYOLITE

Cryolite occurs in commercial quantity and is mined at only one place—Ivigtut, Greenland.

Synthetic cryolite was manufactured in the United States in 1949 by the Aluminum Ore Co. at East St. Louis, Illinois, and the Reynolds Metals Co. at Bauxite (Hurricane Creek), Arkansas.

The following information on cryolite is quoted from Industrial Minerals and Rocks:[17]

> At Ivigtut the cryolite ore is associated with pegmatite within an intrusive mass of porphyritic granite. It lies on the shore of Arsuk Fjord, conveniently situated for mining and shipping the product. The mine is worked from slopes leading from the bottom of an open quarry about 500 ft. long, 300 to 600 ft. wide and 150 ft. deep.
>
> The mine is owned by the Danish State and the mining concession by the Kryolitselskabet Oresund A/D, Copenhagen. The crude ore output is normally divided about equally between the Pennsylvania Salt Manufacturing Co., of Philadelphia, and the Danish company's manufacturing plant in Copenhagen.
>
> The crude ore, as mined and containing silica, fluorspar, galena, pyrite, siderite and host rock gangue, is shipped as is to the Pennsylvania Salt Manufacturing Company's processing plant near Pittsburgh, where it is converted into various manufactured products. Prior to 1935, separation of the ore was mainly effected by gravity, but since that time flotation and other mineral-dressing techniques have been employed to better meet rigid product specifications.
>
> The flotation concentrate is a finely divided white powder typically containing 99.4 pct. natural cryolite. The principal use for this product is in the aluminum industry, where it acts as the electrolyte in reducing alumina to the metal. Artificial cryolite made from fluorspar is used extensively for the same purpose but it has the disadvantage of liberating fluorine-containing gases more readily than the natural product when electrolysis is started, thus causing undesirable working conditions. In the aluminum industry, iron and silica are undesirable impurities.

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[15] Chemical Engineering and Mining Review (Melbourne), vol. 41, No. 10, July 11, 1949, p. 357.

[16] Mining Journal (London), vol. 233, No. 5951, Sept. 10, 1949, p. 532.

[17] Mudd, Henry T., Fluorspar and Cryolite: Industrial Minerals and Rocks, Am. Inst. Min. and Met. Eng., New York, 1949, pp. 396–401, 403.

A high-quality cryolite product is used in the enamel and glass industry. It gives whiteness to enamel and is an opacifier in glass. Here contamination with iron impurities in any form is to be avoided.

Small tonnages are used as a binder for some abrasives and also as insulating material having special dielectric properties.

Some flotation middlings are mixed with rough-dressed ore and then dry-ground to an extremely fine powder, all below 5 microns in size and containing 90 pct. natural cryolite. This product is further processed in various ways and is used exclusively as an insecticide. Natural cryolite, the active ingredient, may be applied to most crops without fear of "burning" and consequent injury to plants. The product usually is mixed with other selective insecticides and wetting or dispersing agents. All such products are proprietary compounds of the Pennsylvania Salt Manufacturing Co. Gangue impurities in these grades merely act as diluents.

Imports of cryolite into the United States were 18,309 long tons valued at $1,312,260 in 1949, compared with 2,101 tons valued at $210,050 in 1948. The cryolite imported in both years came from Greenland.

Exports of cryolite from the United States were 324 long tons valued at $77,709 in 1949, compared with 637 tons valued at $139,027 in 1948. Of the 1949 exports, 130 tons went to Canada, 70 tons to China (Formosa), 53 tons to Mexico, 45 tons to Palestine and Israel, and 26 tons elsewhere.

Fuel Briquets and Packaged Fuel[1]

By J. A. Corgan and Golden V. Chiriaco

GENERAL SUMMARY

CONSISTENT with the general downward trend in the output of solid fuels, there was a sharp decline in the production of both fuel briquets and packaged fuel in 1949, when fuel briquets totaled 2,403,971 net tons, the lowest output since 1943, and packaged fuel 125,948 tons, the lowest annual production since 1936. Briquets were shipped to 37 States and the District of Columbia in 1949. Exports, virtually all destined for Canada, totaled 167,140 tons, and imports, all from Canada, totaled only 365 tons.

Bituminous coal and Pennsylvania anthracite were the principal raw fuels used in the manufacture of fuel briquets and packaged fuel in 1949; asphalt binders were used almost exclusively in making briquets, and both asphalt and starch, together with a small amount of cement, were employed as binders in manufacturing packaged fuel.

FUEL BRIQUETS

Pertinent data on the fuel-briquetting industry from 1945 to 1949 are summarized in table 1. As indicated in this table, the 1949 output is still more than double the average production during the period 1935–39. Production, by regions, from 1917 to 1949 is illustrated in figure 1.

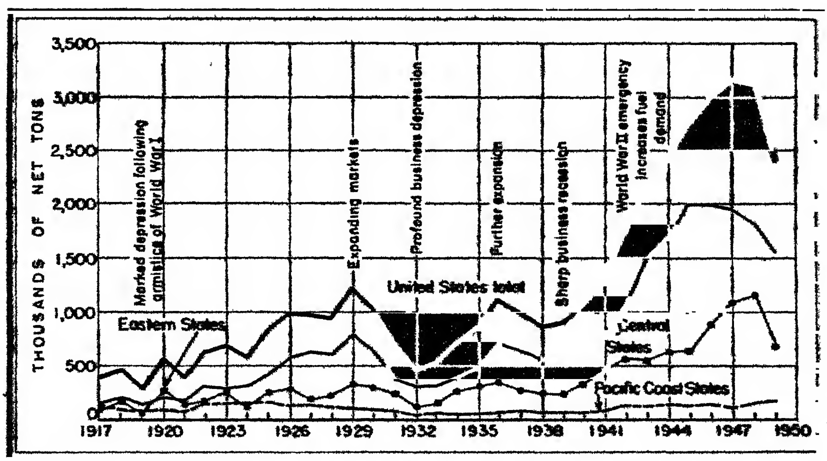

FIGURE 1.—Production of fuel briquets in the United States, by regions, 1917–49

[1] Briquets made from charcoal, wood scrap, and fruit pits are not included in Bureau of Mines review.

TABLE 1.—Salient statistics of the fuel-briquetting industry in the United States, 1935–39 (average), and 1945–49

	1935–39 (average)	1945	1946	1947 [1]	1948	1949
Production:						
Eastern States...net tons..	285,248	637,740	880,109	1,089,705	1,151,041	674,938
Central States.......do.....	588,573	1,991,733	1,986,234	1,966,834	1,820,074	1,557,819
Pacific Coast States.do.....	75,196	132,731	137,684	115,057	157,362	171,214
Total..............do.....	949,017	2,762,204	3,004,027	3,171,596	3,128,477	2,403,971
Imports...............do.....	11,792	722	653	387	329	360
Exports...............do.....	[2] 18,206	174,107	163,339	248,760	207,885	167,140
Consumption, apparent [3] net tons..	942,603	2,588,819	2,841,341	2,923,223	2,920,921	2,237,196
Plants in operation..............	32	32	35	35	36	33
Value of production.............	$6,063,308	$21,678,886	$25,299,612	$30,762,253	$36,011,322	$28,641,424
Average value per net ton f. o. b. plant:						
Eastern States............	$4.28	$5.65	$6.61	$7.82	$9.55	$9.65
Central States............	$7.08	$8.40	$9.03	$10.56	$12.58	$12.59
Pacific Coast States........	$9.23	$10.04	$11.26	$12.77	$13.51	$14.67
World production....net tons..	68,382,000	[4] 34,613,000	[4] 62,118,000	[4] 61,901,000	[4] 68,809,000	70,470,000

[1] Peak year of United States fuel-briquet production.
[2] 1937–39 average. Not reported separately before 1937.
[3] Production plus imports minus exports.
[4] Revised figure.

DOMESTIC PRODUCTION

The decline in the production of fuel briquets from 3,128,477 net tons in 1948 to 2,403,971 in 1949, a 23-percent decrease, can be attributed largely to the unusually mild winters of those years and to competition from other space-heating fuels, especially fuel oil and natural gas. The decrease in production was much more severe in the Eastern States than in the Central States, where briquets are used more extensively than in other areas. The tonnage produced in the Pacific Coast States is not great, and this group of States showed an increase over the 1948 output.

As indicated in table 2, 33 plants[2] produced briquets in 1949. A total of 14 States contributed to the 1949 production, with 22 plants in the Central States accounting for 65 percent of the total output. Wisconsin, with 10 plants and 45 percent of the national output, was the largest individual producing State. Pennsylvania followed with 4 plants, accounting for 14 percent, and West Virginia ranked third with 3 plants operating. Other producing States, in order of output, were as follows: Missouri, Oregon, Illinois, Washington, Arkansas, North Dakota, Kansas, Michigan, California, Nebraska, and Massachusetts. The total value of the 1949 production, $28,641,424, was a decline of 20 percent from the value of $36,011,322 reported in 1948.

[2] Directories of fuel-briquet and packaged-fuel operations and a list of manufacturers of briquetting machinery, M. M. S. 1861, 1862, and 1860, respectively, are obtainable on request from the Bureau of Mines, Washington 25, D. C.

TABLE 2.—Production of fuel briquets in the United States, 1948–49

	1948			1949				
	Plants	Net tons	Value	Plants	Net tons	Value	Percent of change from 1948 in—	
							Tonnage	Value
Eastern States	8	1,151,041	$10,996,787	8	674,938	$6,512,664	−41.4	−40.8
Central States	25	1,820,074	22,888,763	22	1,557,819	19,616,565	−14.4	−14.3
Pacific Coast States	3	157,362	2,125,772	3	171,214	2,512,195	+8.8	+18.2
Total	36	3,128,477	36,011,322	33	2,403,971	28,641,424	−23.2	−20.5

Capacity.—Table 3, showing capacity and production for 1945 to 1949 indicates that, since the peak of 73 percent of capacity was attained in 1945, the trend has been downward, and in 1949 the industry worked at only 52 percent of capacity. In 1949, nine plants, each with an annual capacity of 200,000 tons or more, furnished 1,673,831 tons, or 70 percent of the total production, utilizing 54 percent of their combined capacity. It is of interest to note also that 16 plants with 100,000 tons or more annual capacity accounted for 88 percent of the total production in 1949.

TABLE 3.—Annual capacity and production of briquetting plants in the United States, 1945–49

	Active plants		Production		
	Number	Annual capacity (net tons)	Net tons	Percent of—	
				Annual capacity	Annual production
1945	32	3,782,900	2,762,204	73.0	100.0
1946	35	4,533,300	3,004,027	66.3	100.0
1947	35	4,615,160	3,171,596	68.7	100.0
1948	36	4,670,510	3,128,477	67.0	100.0
1949:					
Capacity of—					
Less than 5,000 tons					
5,000 to less than 10,000	2	39,360	17,799	45.2	.8
10,000 to less than 25,000	2				
25,000 to less than 100,000	13	686,000	270,112	39.4	11.2
100,000 to less than 200,000	7	781,000	442,229	56.6	18.4
200,000 to less than 400,000	6	1,610,000	952,540	59.2	39.6
400,000 or more	3	1,500,000	721,291	48.1	30.0
Total	33	4,616,360	2,403,971	52.1	100.0
Production of—					
Less than 2,000 tons	1	45,360	8,266	18.2	.3
2,000 to less than 5,000	2				
5,000 to less than 10,000	3	64,000	23,257	36.3	1.0
10,000 to less than 25,000	7	351,000	115,575	32.9	4.8
25,000 to less than 100,000	12	1,246,000	641,165	51.5	26.7
100,000 or more	8	2,910,000	1,615,708	55.5	67.2
Total	33	4,616,360	2,403,971	52.1	100.0

Raw Fuels.—Bituminous coal was the principal raw fuel used in the manufacture of fuel briquets in 1949, followed in order by Pennsylvania anthracite and Arkansas hard coals. These fuels accounted for 89 percent of the raw fuels used. In addition, small amounts of residual carbon from the manufacture of oil gas, residual carbon from pyrolysis of natural gas, lignite char, and petroleum coke were used as raw fuels. Yard screenings used at 14 plants comprised about 20 percent of the raw fuels used in the manufacture of briquets in 1949. Pennsylvania anthracite was used extensively, either alone or in combination with bituminous coal, in Pennsylvania and Wisconsin. Bituminous coal was used widely in the Eastern and Cen-

TABLE 4.—Raw fuels used in making fuel briquets in the United States in 1949

Character of raw fuels used	Plants	Net tons
Pennsylvania anthracite	17	646,645
Arkansas hard coals	7	303,730
Bituminous low-volatile	17	969,514
Bituminous high-volatile	4	88,994
Semicoke (lignite char)	1	193,664
Residual carbon from pyrolysis of natural gas	1	
Residual carbon from manufacture of oil gas	2	
Petroleum coke	3	66,247
Total	[1] 33	2,268,794

Plants using—	Plants	Raw fuels used (net tons): Yard screenings	Other raw fuels	Total
Yard screenings exclusively (from own or other yards)	3	76,427		76,427
Raw fuels (other than yard screenings) exclusively	19		1,169,795	1,169,795
Both yard screenings and other raw fuels	11	378,620	643,952	1,022,572
Total	33	455,047	1,813,747	2,268,794

[1] A number of plants used more than 1 kind of raw fuel; hence, the sum of the plants above is greater than the actual number of plants active (33) in 1949.

TABLE 5.—Production of fuel briquets, grouped according to location of plants with reference to supply of raw fuel, 1948–49

Location of plant	1948 Plants	1948 Production (net tons)	1949 Plants	1949 Production (net tons)	Change in 1949 Net tons	Change in 1949 Percent
Near lake coal docks:						
Lake Superior	4	840,864	4	695,856	−145,008	−17.2
Lake Michigan	8	458,269	7	428,842	−29,427	−6.4
Lake Huron	1		1			
Total	13	1,299,133	12	1,124,698	−174,435	−13.4
Near coal mines:						
Eastern States	6	1,149,533	7	674,717	−474,816	−41.3
Central States	9	489,927	9	421,721	−68,206	−13.9
Total	15	1,639,460	16	1,096,438	−543,022	−33.1
Near petroleum refineries and oil- and natural-gas plants:						
Central States	1	174,421	---	171,214	−3,207	−1.8
Pacific Coast States	3		3			
Total	4	174,421	3	171,214	−3,207	−1.8
Other locations:						
Eastern States	2	15,463	1	11,621	−3,842	−24.8
Central States	2		1			
Total	4	15,463	2	11,621	−3,842	−24.8
Total United States	36	3,128,477	33	2,403,971	−724,506	−23.2

tral States. Residual carbon from oil gas and natural gas was the principal raw fuel used in the Pacific Coast States.

Binders.—Asphalt binders were used almost exclusively in making briquets in the United States. In 1949, 31 operators used approximately 151,000 tons of asphaltic binders and very small quantities of coal-tar pitch; 2 operators used no binder. The percentage of binder in the briquets (by weight) ranged from less than 5 to 9 percent or more. Twenty-six plants, accounting for about 90 percent of the 1949 production, used binders ranging from 5 to 8 percent of the weight of the briquets.

TABLE 6.—Classification of briquetting plants in the United States by type of binder used, 1946–49

	1946		1947		1948		1949	
	Plants	Percent of total briquet production	Plants	Percent of total briquet production	Plants	Percent of total briquet production	Plants	Percent of total briquet production
Type of binder used:								
No binder [1]	2	92.3	2	95.8	2	95.9	2	100.0
Asphalt	30		30		31		30	
Asphalt and coal-tar pitch	1	7.7	1	4.2	1	4.1	1	
Asphalt and starch	1		1		------		------	----------
Oil-gas tar pitch	1		1		1		------	----------
Rosin and wax	------		------		1		------	----------
Total	35	100.0	35	100.0	36	100.0	33	100.0
Production (net tons)	------	3,004,027	------	3,171,596	------	3,128,477	------	2,403,971

[1] Residual carbon from manufacture of oil gas and bituminous coal were raw fuels used at plants employing no binder.

SHIPMENTS

Weight and Shape.—In 1949 briquets ranged in weight from 1½ to 20 ounces. Pillow shapes under 5 ounces (except for an 11-ounce bituminous high-volatile pillow) were made at 30 plants and represented 82 percent of the total production; 2½-ounce cylindrical (barrel-shaped) and 18- and 20-ounce cubes supplied 18 percent of the total production.

In addition to the 2,182,671 tons of fuel briquets shipped to 37 States and the District of Columbia in 1949, 167,140 tons were exported to Canada, including a small tonnage to Newfoundland-Labrador. Imports, all from Canada, amounted to 365 tons. As indicated in table 7, Wisconsin, Minnesota, Missouri, and Michigan received 1,275,919 tons of the total briquets shipped in 1949. The difference between production in 1949 (2,403,971 net tons) and shipments within the United States (2,182,671 tons), or 221,300 tons, represents briquets exported, used at plants for power or heat, and changes in producers' stocks. Briquets are used almost entirely for space heating, but in 1949 operators reported 3,923 tons used for power or heat at their plants.

Seventy-seven percent of the total shipments of fuel briquets moved by rail and 23 percent by truck in 1949. In the Eastern States, 96 percent was shipped by rail and 4 percent by truck; in the Central States, 72 percent moved by rail and 28 percent by truck; and in the Pacific Coast States, 47 percent moved by rail and 53 percent by truck.

TABLE 7.—Shipments of fuel briquets of domestic manufacture in the United States, by States of destination, as reported by producers, 1948–49, in net tons [1]

State of destination	1948	1949	State of destination	1948	1949
Arkansas	1,098	2,727	New Hampshire	6,616	2,515
California	13,245	15,770	New Jersey	25,852	21,255
Connecticut	3,958	2,834	New York	44,411	20,302
Delaware	937	368	North Carolina	23,761	17,257
District of Columbia	2,569	1,169	North Dakota	118,092	104,741
Florida	517	53	Ohio	87,027	56,982
Georgia	104		Oregon	78,303	76,755
Idaho	186	255	Pennsylvania	87,994	38,689
Illinois	134,509	128,729	Rhode Island	3,707	1,702
Indiana	82,253	68,999	South Carolina	6,577	2,779
Iowa	101,201	86,567	South Dakota	112,041	96,045
Kansas	23,085	22,330	Tennessee	49	821
Kentucky	5,558	4,264	Texas		66
Maine	10,930	5,258	Utah	52	
Maryland	24,555	14,955	Vermont	3,972	1,686
Massachusetts	29,361	11,018	Virginia	36,449	25,071
Michigan	339,137	225,461	Washington	36,977	26,696
Minnesota	434,595	341,057	West Virginia	2,135	1,714
Missouri	343,743	272,228	Wisconsin	542,634	437,173
Montana		34			
Nebraska	42,056	46,346	Total	2,810,246	2,182,671

[1] For shipments outside the United States see export statistics, table 9.

TABLE 8.—Direct shipments of fuel briquets by rail and truck, as reported by producers, 1948–49, in net tons [1]

Produced in—	1948			1949		
	Rail	Truck	Total	Rail	Truck	Total
Eastern States	1,118,492	32,826	1,151,318	650,902	24,447	675,349
Central States	1,421,330	534,041	1,812,736	1,111,686	442,442	1,554,128
Pacific Coast States			[2] 142,635	68,190	78,023	146,213
Total United States	2,539,822	566,867	[3] 3,106,689	1,830,778	544,912	[3] 2,375,690

[1] Includes shipments outside the United States.
[2] Includes small tonnage shipped by scow.
[3] An additional 22,283 tons were used by 4 producers as fuel at their plants in 1948 and 3,923 tons by 3 producers in 1949.

PRICES

As indicated in table 1, the average per ton value of briquets (f. o. b. plant) produced in the Eastern, Central, and Pacific Coast States increased substantially each year during the period 1945–48; however, the increases shown for 1949 over 1948 are in most cases negligible and not nearly so large as those shown for previous years. Sales values received by producers (f. o. b. plant) vary greatly because of the different local conditions under which briquets are made. In the Eastern States, briquets are made relatively near the coal fields where the cost of raw fuel does not involve large freight charges; hence the f. o. b. plant value is relatively low. In the Central States briquets are generally made at plants great distances from the original coal source; consequently, raw fuel at these plants involves a considerable freight charge, which is reflected in higher values per ton f. o. b. plant. The highest plant values are shown in the Pacific Coast States, where

the raw feuls used are residual carbons from the manufacture of oil gas and pyrolysis of natural gas.

These values vary considerably from the prices at which briquets are sold to consumers, as retail prices include transportation costs to market and retail dealers' margins. Retail prices of fuel briquets for certain selected cities may be obtained from the Bureau of Labor Statistics, United States Department of Labor, Washington 25, D. C.

FOREIGN TRADE [3]

Imports of fuel briquets into the United States reached a peak of 123,593 net tons in 1926, when a strike in the Pennsylvania anthracite fields created a shortage of fuels in this country. Imports have been negligible since 1941, amounting to only a few hundred tons a year; and in 1949 only 365 tons, all of which came from Canada, were imported.

In 1949 exports of fuel briquets, all to Canada and Newfoundland-Labrador, totaled 167,140 tons, a decline of 20 percent from 1948. The value of the 1949 exports was $2,438,284, a decrease of 8 percent from 1948.

TABLE 9.—Briquets (coal and coke) exported from the United States, 1947–49, by countries of destination and customs districts

[U. S. Department of Commerce]

	1947		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value
COUNTRY						
Canada	238, 081	$2,633,912	207, 142	$2,644,598	166, 961	$2, 436, 004
Newfoundland-Labrador	------	------	671	8, 440	179	2, 280
Denmark	8	180	20	374	------	------
Dominican Republic	4	89	------	------	------	------
French West Africa	10, 621	156, 453	------	------	------	------
Ireland	30	613	4	90	------	------
Mexico	10	130	48	480	------	------
Trinidad and Tobago	6	58	------	------	------	------
Total	248, 760	2, 791, 435	207, 885	2, 653, 982	167, 140	2, 438, 284
CUSTOMS DISTRICT						
Arizona	10	130	48	480	------	------
Buffalo	86, 033	1, 040, 963	104, 715	1, 383, 557	84, 750	1, 285, 968
Dakota	50, 996	515, 135	37, 862	478, 505	35, 871	481, 934
Duluth and Superior	39, 579	417, 164	22, 322	294, 613	16, 733	224, 708
Maine and New Hampshire	1, 022	11, 970	261	3, 130	1, 077	19, 361
Maryland	10	195	------	------	------	------
Michigan	18, 696	162, 024	13, 095	125, 932	4, 629	61, 222
New Orleans	10, 627	156, 511	------	------	------	------
New York	14	320	20	374	------	------
Ohio	202	2, 465	4, 319	40, 839	------	------
Philadelphia	4	99	675	8, 530	740	9, 397
Puerto Rico	4	89	------	------	------	------
Rochester	26, 920	256, 914	7, 569	86, 783	4, 123	28, 907
St. Lawrence	13, 788	218, 722	8, 542	138, 793	12, 555	243, 713
Vermont	45	320	430	4, 799	64	512
Virginia	10	179	------	------	------	------
Washington	800	8, 235	8, 027	87, 647	6, 598	82, 572
Total	248, 760	2, 791, 435	207, 885	2, 653, 982	167, 140	2, 438, 284

[3] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TECHNOLOGIC DEVELOPMENTS

The recovery, upgrading, and utilization of fine sizes of anthracite have received considerable technological consideration during the past several years, and the Anthracite Institute and the Pennsylvania State College have released a number of reports on pelletization or the briquetting of anthracite fines by extrusion. These reports discuss the machines, binders, and wetting agents used; the properties of the silts briquetted; and the relation of silt composition to the strength and combustion characteristics of the pellets.

Considerable research on the briquetting of various coals has been conducted during the past several years by the Illinois State Geological Survey, the University of Utah, and the University of Wyoming. Detailed data on briquetting of dried low-rank western coals are contained in a report [4] released in 1949 by the University of Wyoming. The report presents the results of a research project designed to provide information to increase the utilization value of low-rank western coals by drying and briquetting. The technical data contained in the report are from laboratory and pilot-plant studies conducted by the university in cooperation with the Bureau of Mines. An interesting conference [5] was held in June 1949 at the University of Wyoming to discuss various coal-briquetting processes and procedures.

The Bureau of Mines compiled a bibliography on briquetting.[6]

WORLD PRODUCTION

Data on the production of fuel briquets in all countries are not available; however, as indicated in table 10, Germany is apparently the world's greatest producer of fuel briquets. Although Germany showed a substantial increase over 1948, a number of other countries showed decreases.

[4] Boley, Charles C., and Rice, Neal, Briquetting of Dried Low-Rank Western Coals: University of Wyoming Natural Resources Research Inst. Bull 3, November 1949, 76 pp.

[5] Proceedings of a Coal Briquetting Conference sponsored by the Natural Resources Research Institute, University of Wyoming, June 24–25, 1949, Laramie, Wyo., Inf. Circ. 3, October 1949, 118 pp.

[6] Fisher, Paul L., A Selected Bibliography on Briquetting of Coal and Other Carbons; Bureau of Mines Inf. Circ. 7469, 1948, 15 pp.

TABLE 10.—World production of fuel briquets, by countries, 1945–49, in metric tons [1]

[Compiled by Pauline Roberts]

Country [1]	1945	1946	1947	1948	1949
Algeria	101,756	97,518	82,888	77,820	56,616
Australia: Victoria [2]	512,349	522,157	420,340	(3)	(3)
Belgium	787,530	1,079,620	1,352,690	988,790	780,860
Canada	275,941	299,100	290,707	323,133	459,908
Czechoslovakia:					
Bituminous coal	71,309	209,180	259,130	(3)	(3)
Lignite	192,485	252,452	283,645	291,326	(3)
France	3,471,269	5,162,450	5,118,830	5,948,000	(3)
French Indochina	1,940	4,710	(3)	12,000	(3)
French Morocco	38,530	22,202	46,215	22,959	[4] 15,000
Germany:					
Federal Republic:					
Bituminous coal [5]	1,323,000	1,902,000	2,176,000	2,972,000	3,586,000
Lignite [5]	4,568,000	10,774,000	11,840,000	12,898,000	14,250,000
Soviet zone: Lignite [4]	14,000,000	28,600,000	26,000,000	30,000,000	30,000,000
Hungary:					
Bituminous coal	(3)	20,210	70,970	(3)	(3)
Lignite	[6] [7] 13,450	33,670			
India	7,528	19,761	(3)	----------	(3)
Indonesia	(3)	(3)	[4] 2,000	9,420	25,323
Ireland	118,558	85,781	53,311	[4] 23,400	(3)
Japan	[2] 383,481	(3)	(3)	577,501	355,366
Korea, South	(3)	[8] 105,000	200,994	76,724	168,358
Netherlands:					
Bituminous coal	412,571	725,859	910,046	935,865	992,000
Lignite	35,757	43,655	41,673	62,988	61,000
New Zealand	9,941	13,183	11,592	13,113	(3)
Pakistan	(9)	(9)	(3)	4,596	(3)
Poland:					
Bituminous coal	93,078	529,082	631,915	717,508	796,000
Lignite	----------	27,190	41,697	113,633	175,000
Portugal	72,177	77,276	97,418	49,681	(3)
Spain	1,049,520	833,445	789,535	1,005,285	1,140,959
Tunisia	16,619	32,347	36,764	45,746	43,153
Turkey	23,782	12,572	15,130	7,426	40,102
United Kingdom	1,002,841	1,567,765	1,863,436	1,475,305	1,536,266
United States:					
Briquets	2,505,816	2,725,193	2,877,208	2,838,092	2,180,884
Packaged fuel	188,823	173,198	165,906	142,439	114,258
Total	31,400,000	56,353,000	56,156,000	62,423,000	63,929,000

[1] In addition to countries listed, briquets are produced in Bulgaria, Italy, Mexico, Rumania, Sweden, U. S. S. R., and Yugoslavia, but production figures are not available; estimate not included in total.
[2] Fiscal year ended Mar. 31 of year following that stated.
[3] Data not available; estimate included in total.
[4] Estimate.
[5] British and American zones only.
[6] Data represent Trianon Hungary subsequent to October 1944.
[7] June to December, inclusive.
[8] August to December, inclusive.
[9] Included with India.

PACKAGED FUEL

Salient statistics of the packaged-fuel industry in the United States from 1945 to 1949 are summarized in table 11. Production, by regions, for 1935–49 is illustrated in figure 2.

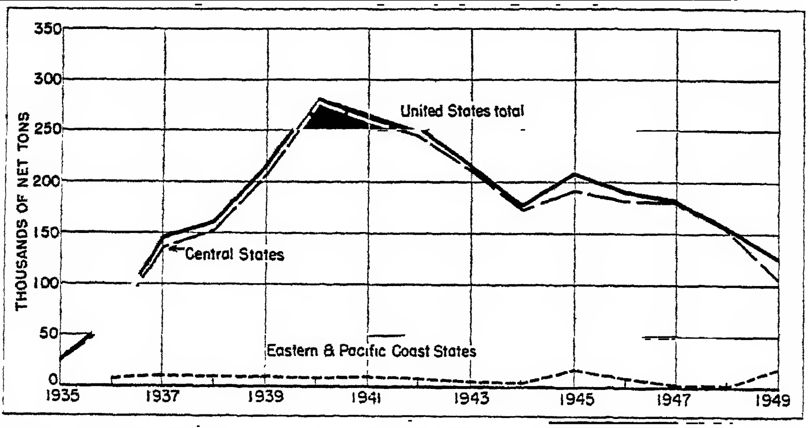

FIGURE 2.—Production of packaged fuel in the United States, by regions, 1935–49. (No production in Pacific Coast States, 1943–49.)

At the 1950 annual convention of the National Association of Packaged Fuel Manufacturers, held in St. Louis in June, there was considerable discussion regarding a new process [7] that has been developed for making packaged fuel by extrusion. The discussion referred particularly to the saving of costly labor in the new process and the density and hardness of the product.

TABLE 11.—Salient statistics of the packaged-fuel industry in the United States, 1935–39 (average), 1940, and 1945–49

	1935–39 (average)	1940 (peak year of production)	1945	1946	1947	1948	1949
Production:							
Eastern States ... net tons	5,052	6,349	16,606	9,065	2,153	1,859	125,948
Central States ... do	116,218	276,994	191,537	181,854	180,728	155,154	
Pacific Coast States ... do	1,563	1,170	------	------	------	------	------
Total ... do	122,833	284,513	208,143	190,919	182,881	157,013	125,948
Plants in operation	63	106	61	70	62	62	57
Value of production	$1,050,566	$2,391,922	$2,518,636	$2,496,388	$2,882,105	$2,735,861	$2,236,748
Average value per net ton f. o. b. plant:							
Eastern States	$9.45	$9.02	$12.86	$12.93	$16.58	$17.64	$17.77
Central States	$8.50	$8.36	$12.04	$13.08	$15.75	$17.42	$17.76
Pacific Coast States	$9.91	$12.82	------	------	------	------	------

[7] National Association of Packaged Fuel Manufacturers, (1801 Gage Blvd., Topeka, Kans.), Sales-Merchandising Bull. vol. 11, No. 8, June 24, 1950, 9 pp.

DOMESTIC PRODUCTION

In 1949, 57 plants operated in the United States, as compared with 62 plants in 1948, and produced 125,948 net tons of packaged fuel valued at $2,236,748, a decrease of 20 percent in tonnage and 18 percent in value from the preceding year. Michigan and Ohio were the two largest producing States in the order named and accounted for about 54 percent of the 1949 output. As indicated in table 11, the average value per net ton (f. o. b. plant) of packaged fuel has increased consistently in both the Eastern and Central States from 1945 to 1949, inclusive; however, the increase per ton shown for 1949 over 1948 is small when compared with the increases indicated for other years. The values received by the manufacturers comprise cost of coal at the mine, freight rates, direct and indirect manufacturing costs, and profit and hence may vary greatly from plant to plant, depending upon local conditions under which the product is manufactured. Production of packaged fuel by States for 1948–49 is shown in table 12.

TABLE 12.—Production of packaged fuel in the United States, 1948–49, by States

State	1948			1949		
	Plants	Net tons	Value	Plants	Net tons	Value
Michigan	22	55,559	$897,647	19	39,254	$660,874
Minnesota	4	17,401	372,507	4	16,197	332,100
Ohio	17	27,776	509,169	17	28,768	516,792
Wisconsin	8	35,143	600,658	7	23,720	402,560
Other States	[1] 11	21,134	355,880	[1] 10	18,009	324,422
Total	62	157,013	2,735,861	57	125,948	2,236,748

[1] Comprises 2 plants each in Illinois, Indiana, and Virginia, and 1 plant each in Iowa, Kentucky, Maine (none in 1949), Missouri, and Nebraska.

Number of Plants.—Of the 57 plants[8] producing packaged fuel in 1949, 19 plants were located in Michigan and accounted for 31 percent of the total output; and 17, located in Ohio, accounted for about 23 percent of the production. Wisconsin was the third-largest producing State.

Capacity of Plants.—Table 13 gives comparative data on capacity and production for 1945–49, inclusive, as reported by packaged-fuel operations active in those years. In 1949, 15 large plants with a capacity of 5,000 tons or more, operating at 39 percent of their combined capacity, produced 88,738 tons of packaged fuel, or 70 percent of the total 1949 output. Forty-two plants, each with an annual capacity under 5,000 tons, produced 37,210 tons or 30 percent of the total production, utilizing 35 percent of their combined capacity.

[8] Work cited in footnote 2.

TABLE 13.—Annual capacity and production of packaged-fuel plants in the United States, 1945–49

	Active plants		Production		
	Number	Annual capacity (net tons)	Net tons	Percent of— Annual capacity	Percent of— Annual production
1945	61	452,320	208,143	46.0	100.0
1946	70	530,760	190,919	36.0	100.0
1947	62	427,200	182,881	42.8	100.0
1948	62	397,620	157,013	39.5	100.0
1949:					
Capacity of—					
Less than 5,000 tons	42	106,000	37,210	35.1	29.5
5,000 to less than 10,000	6	35,300	10,598	30.0	8.4
10,000 to less than 15,000	4	42,000	19,971	47.6	15.9
15,000 to less than 25,000	2	} 148,000	58,169	39.3	46.2
25,000 to less than 40,000	2				
60,000 tons or more	1				
Total	57	331,300	125,948	38.0	100.0
Production of—					
Less than 500 tons	18	35,610	5,460	15.3	4.3
500 to less than 1,000	14	52,720	9,954	18.9	7.9
1,000 to less than 3,000	17	67,970	32,948	48.5	26.2
3,000 to less than 5,000	2	} 67,000	26,303	39.3	20.9
5,000 to less than 10,000	3				
10,000 to less than 25,000	3	108,000	51,283	47.5	40.7
Total	57	331,300	125,948	38.0	100.0

Raw Fuels.—Five kinds of raw fuels entered into the manufacture of packaged fuel in 1949. Bituminous low-volatile coal at 50 plants, used either alone or in combination with other fuels, comprised 90 percent of the total raw fuels used. Small quantities of bituminous high-volatile coal, Pennsylvania anthracite, semianthracite, and petroleum coke were used also in the manufacture of packaged fuel in 1949. Yard screenings were used exclusively at 27 plants to produce 26 percent of the total output; raw fuels other than yard screenings were used exclusively at 12 plants to manufacture 27 percent; and both screenings and other raw fuels combined were used at 18 plants to produce 47 percent of the total 1949 production.

TABLE 14.—Raw fuels used in making packaged fuel in the United States, 1949

Character of raw fuels used	Plants	Net tons	Plants using—	Plants	Raw fuels used (net tons) Yard screenings	Other raw fuels	Total
Bituminous low-volatile	50	113,027	Yard screenings exclusively (from own or other yards)	27	31,875	-------	31,875
Bituminous high-volatile	5	2,815	Raw fuels (other than yard screenings) exclusively	12	-------	34,319	34,319
Pennsylvania anthracite	1	} 3,689	Both yard screenings and other raw fuels	18	22,107	37,085	59,192
Semianthracite	3						
Petroleum coke	6	5,855					
Total	[1] 57	125,386	Total	57	53,982	71,404	125,386

[1] A number of plants used more than 1 kind of raw fuel; hence, the sum of the plants above is greater than the actual number of plants active (57) in 1949.

Binders.—Starch, totaling 691 tons, or an average of about 14 pounds per ton of packaged fuel produced, is the principal binder employed and was used at 52 plants producing about 78 percent of the total 1949 output. Asphalt, totaling 1,676 tons, or about 127 pounds per ton, was used exclusively at three plants, and cement, in small quantities, about 71 pounds per ton, was also used as a binding agent. Table 15 gives details on binders used in manufacturing packaged fuel for 1946–49.

TABLE 15.—Classification of packaged-fuel plants in the United States by type of binder used, 1946–49

	1946		1947		1948		1949	
	Plants	Percent of total packaged-fuel production	Plants	Percent of total packaged-fuel production	Plants	Percent of total packaged-fuel production	Plants	Percent of total packaged-fuel production
Type of binder used:								
Starch	65	72.7	58	77.9	57	79.8	52	78.3
Asphalt	3	26.0	2		3	19.5	3	20.6
Starch and asphalt	1	1.3	1	22.1	1	.7	1	1.1
Cement	2		2		2		2	
Total	[1] 70	100.0	[1] 62	100.0	[1] 62	100.0	[1] 57	100.0
Production (net tons)		190,919		182,881		157,013		125,948

[1] 1 plant making 2 types of packaged fuel used starch binder for 1 and asphalt and starch for the other; hence the sum of the items shown exceeds the number of active plants.

SHIPMENTS

Sales of packaged fuel in 1949 amounted to 125,948 net tons, of which 108,606 tons (86 percent) were listed as local sales (by truck) and 17,342 tons (about 14 percent), were reported as other than local sales. Of the 17,342 tons shipped outside the local area, 11,036 tons (about 64 percent) went by truck and 6,306 tons (36 percent) by rail.

TABLE 16.—Shipments of packaged fuel in the United States by method of transportation, 1945–49, in net tons

Year	Shipped by truck			Shipped by rail	Total
	Local sales [1]	Other than local sales	Total truck		
1945	171,621	23,381	195,002	11,713	206,715
1946	150,770	25,262	176,032	14,555	190,587
1947	147,599	23,749	171,348	11,270	182,618
1948	128,661	17,753	146,414	10,272	156,686
1949	108,606	11,036	119,642	6,306	125,948

[1] Includes sales called for and delivered.

Gem Stones

By W. F. Foshag,[1] George Switzer,[1] and G. W. Josephson

THE JEWELRY INDUSTRY IN 1949

AT THE close of 1948 business as a whole in the United States was at its all-time peak. The jewelry volume had declined from its sensational 1947 peak. The traditional seasonal pattern of the jewelry industry reasserted itself for the first time in 10 years. Prices in general began to decline in early 1949, and jewelers liquidated their stocks to establish low inventories. During spring and early summer business was quiet but became active in July and August, when business confidence was restored, and was reasonably so during the fall months; the weeks before Christmas saw the traditional rush for jewelry-store merchandise. High-priced diamond jewelry lagged, however, because of anticipated reduction of present excise taxes. According to a survey made by the National Wholesale Jewelers' Association, diamond sales showed a 19-percent decline in 1949 compared to 1948.

The Jewelers' Circular-Keystone, using United States Department of Commerce statistics and Internal Revenue (excise tax receipts) data, figured that the volume done by jewelry stores in 1949 was approximately $1,055,000,000, a decline of 12 percent from 1948.

FASHIONS IN JEWELS

The fashion aspect of the jewelry industry received more recognition in 1949 than ever before. The Jewelry Industry Council appointed a fashion director and began to include jewelry fashion shows and other forms of jewelry entertainment for the fashion press in its regular schedule of activities. A fashion advisory committee of the Jewelry & Allied Industries was organized to bring together designers, artisans, and promoters in the fields of apparel and jewelry. These organizations deal with costume jewelry as well as with diamonds and other precious jewelry.

The fashion picture as a whole was conservative. Paris made no radical change in styles. However, there was a strong trend in America toward the styles of the 1920's, and the persistence of this trend is slowly affecting the design of jewelry. Bracelets are becoming increasingly popular, as are longer chains and pendants. The most noticeable change in jewelry fashion was the return to pendant earrings. The trend is more and more toward white metals for the

[1] Smithsonian Institution; consulting mineralogist to Bureau of Mines.

mounting of diamonds, but in the more elaborate pieces very little metal was visible. Manufacture was ingenious from the standpoint of mechanical construction. Diamonds were set in hundreds of tiny links, invisibly hinged to form mobile showers of baguettes and "trembling" leaves, stems, and petals. Kite, keystone, and triangle cuts were incorporated into this fine jewelry, and the marquise and pear shape continued to be used.

In diamond engagement-ring mountings the locked-together types of engagement ring and wedding band have become more common. Ingenuity continued to make small diamonds look larger. The demand for straight-sided stones, especially diamond, increased.

DOMESTIC PRODUCTION

For many years the United States has produced a large variety of gem materials but has never been an important factor in world gem production. Gem mining has been and probably will continue to be a minor mining industry.

No large gem-mining companies exist in the United States. A few small companies have been organized from time to time to work certain deposits, such as jade, turquoise, sapphire, and tourmaline. Some professional lapidary shops employ a few miners. In addition, thousands of amateur lapidaries spend their vacations and weekends searching for gem materials, particularly for varieties of quartz (agate, jasper, and petrified wood). Many of their products go to local jewelers or roadside curio shops, particularly in southwestern, western, and northwestern States. As a hobby, the lapidary craft is continuing to spread.

No reliable statistics exist as to the value of the domestic output of gem stones; in the rough it may approximate $400,000 to $500,000 and more than double that after cutting.

The many forms of quartz, chiefly the cryptocrystalline varieties, led the field, with jade second and turquoise third. Of the States, Oregon, Wyoming, Washington, and Texas were the leaders.

Agate.—Agate production, including all other varieties of chalcedony, such as jasper and petrified wood, is increasing as interest in the lapidary craft grows. "Thunder eggs" continued to be produced, chiefly in Oregon. The well-known Yellowstone River moss-agate locality in Montana is still producing but in ever decreasing quantity, with few if any full-time agate hunters.

It is estimated that over 50 tons of agate were produced in New Mexico, plus an additional unknown amount picked up by private collectors. Considerable agate was produced in west Texas, mostly near Alpine, in the Big Bend section, and near Laredo. South Dakota produced some agate, mined by Scott's Rose Quartz Co.

A relatively large amount of agatized wood was collected on the borders of the Petrified Forest National Monument, Ariz. New finds of petrified wood were reported from various localities in Oregon and Washington.

A small amount of chrysoprase was mined at Porterville, Calif.

Red jasper from Vermont was offered in ton lots, mined by the Burlington Gem Co.

Jade.—Allan Branham, Lander, Wyo., stated that the light-green jade (nephrite) in Wyoming is largely depleted but that new finds of dark green and black had been made. The year 1949 was the poorest in the past 13 for Wyoming jade; total sales were approximately $20,000, with the price of light green ranging from $10 to $15 per pound and dark green and black from $5 to $10 per pound.

A large deposit of black jade was found at Kortes Dam, Wyo. A single piece weighing 1,500 pounds was taken out. A newly discovered field at Daniel, Wyo., is reported to be of poor quality.

The American Jade Co., Denver, Colo., reportedly spent over $50,000 developing its jade deposit in the Sweetwater River area, Wyoming.

A new deposit of nephrite jade was discovered on Lewis Hill, 2 miles north of Porterville, Tulare County, Calif.; 1 ton was mined, with several more tons in sight. The jade is reported to vary in color from medium to dark green, with excellent translucency. Operators of the mine are Frank Janolco and F. V. Alston, Porterville.

Some nephrite jade was produced from the Monterey County, Calif., locality, chiefly by amateur collectors.

In November 1949 a deposit of jadeite jade was found on Clear Creek, San Benito County, Calif., by the late L. Ph. Bolander, K. J. Fritsch, and Buck Bleifus. The jadeite mined thus far has been dark green and not of gem quality. Considerable interest is being manifested in this deposit because it represents the first discovery of jadeite jade in the Western Hemisphere other than worked pieces in the tombs of ancient civilizations in Central America.

The Havenstrite Mining Co. (formerly Arctic Circle Exploration Co.) mined no jade in the Kobuk area, northwestern Alaska, during 1949, and reports no known mining by any other organization or individual in the Territory.

Turquoise.—Production of turquoise in the Southwest appears to be steadily diminishing. The Southwest Gem & Jewelry Co. mined 75 to 100 pounds at its Cerebrat ranch, Arizona, property. There was no production reported from New Mexico during the year. Some turquoise is mined in Lander County, Nev.

Diamond.—In October 1948 mining operations in the well-known diamond-bearing kimberlite pipes near Murfreesboro, Ark., were started once again, after a shut-down of many years, by a diamond corporation headed by Glenn L. Martin. Milling was carried on in a washing and recovery mill having a capacity of 1,000 tons a day. Surface-mining methods were used. After 120 thousand tons of various surface ores had been mined from numerous localities in the 60 acres showing peridotite, the enterprise was closed as of September 1949.

The company obtained approximately 840 diamonds, the largest a stone of 4¼ carats. Ninety percent of the stones recovered were small industrials from one-tenth to 1 carat in size. Total diamonds produced weighed 246.15 carats. The indicated yield of the ground treated is 0.16 carat per 100 loads (16 cubic feet), compared with 24 carats per 100 loads for the Premier mine in South Africa. The production consisted of 10 percent very imperfect distorted pieces of mixed color, 5 percent seconds of dark-brown tint, 20 percent small-

size mixed industrials, and 65 percent crushing boart. The appraised valuation was $984.60.

A 3.93-carat diamond was found near Peru, Miami County, Ind., in 1949.

Other Gem Stones.—Utah reported that about the normal amount (300 pounds) of variscite was produced, mostly from the Clay Canyon deposit.

Scott's Rose Quartz Co. mined about 100 pounds of rose quartz in South Dakota. The Bumpus quarry, Albany, Maine, reopened and produced about 50 tons of rose quartz, much of good color, including a single piece weighing 2,000 pounds.

Some transparent light-yellow labradorite was produced in Utah, probably not over 25 pounds in all.

No sapphires were produced at the Yogo sapphire mine, Montana. The mine has been taken over by a new company, the Yogo Sapphire Mining Co. It is reported that the mine will be reopened and worked during 1950.

Arkansas continued to produce some quartz crystals.

A number of good crystals of green tourmaline were produced in the Pala District, San Diego County, Calif., some of which were cut into stones of over 1 carat. Some golden and pale-pink beryl and a very small amount of kunzite were also produced.

A very fine gem-quality green beryl crystal, weighing 14½ ounces, was found in Riverside County, Calif. The exact locality has been withheld pending further exploration by the discoverers.

Other gem stones produced in small amounts in 1949 in the United States follow: Beryl, Mt. Antero, Colo.; amblygonite, beryl, and spodumene, Maine; idocrase ("californite"), Siskiyou County, Calif.; and topaz, Texas and Utah.

CANADIAN GEM STONES

Again in 1949 Canada produced very little in the way of gem stones. A few tons each of sodalite, peristerite, amazonite, and labradorite find their way each year to dealers in Canada and the United States. The annual value of Canada's gem-stone production probably does not exceed a few hundred dollars.

IMPORTS [3]

Imports of gem stones, exclusive of industrial diamonds, in 1949, as reported by the United States Department of Commerce, totaled $84,185,631, about 27 percent less than in 1948. Of the total, diamonds comprised 83 percent.

[3] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Precious and semiprecious stones (exclusive of industrial diamonds) imported for consumption in the United States, 1948–49

[U. S. Department of Commerce]

Commodity	1948		1949	
	Carats	Value	Carats	Value
Diamonds:				
Rough or uncut (suitable for cutting into gem stones), duty-free	[1] 909,871	[1] $44,400,481	651,150	$28,299,799
Cut but unset, suitable for jewelry, dutiable	[1] 388,499	56,244,934	335,487	41,427,718
Emeralds:				
Rough or uncut, duty-free	4,937	28,054	80,231	226,233
Cut but not set, dutiable	11,213	286,565	13,723	284,578
Pearls and parts, not strung or set, dutiable:				
Natural		772,763		532,310
Cultured or cultivated		748,302		1,733,698
Other precious and semiprecious stones:				
Rough or uncut, duty-free		258,553		208,124
Cut but not set, dutiable		3,160,778		2,045,476
Imitation, except opaque, dutiable:				
Not cut or faceted		53,133		36,090
Cut or faceted:				
Synthetic		777,224		680,428
Other		8,904,941		8,495,151
Imitation, opaque, including imitation pearls, dutiable		59,610		37,819
Marcasite, dutiable:				
Real		[1] 225,638		170,405
Imitation		19,055		7,802
Total		[1] 115,940,031		84,185,631

[1] Revised figure.

DIAMOND

World production of diamonds was about 36 percent greater in 1949 than in 1948. Output for the Union of South Africa was approximately the same. The large increase came from the Belgian Congo, where production increased from a little less than 6,000,000 carats to over 9,600,000 carats. Tanganyika continued to show a steady rise.

Sales of rough by the principal distributors (Diamond Trading Co. for gem diamonds and Industrial Distributors (1946), Ltd., for industrial diamonds) were £28,446,000 for 1949 as compared with a little over £38,000,000 in 1948.

Cutting.—The number of employed cutters fluctuated throughout 1949 with the course of business, and there was considerable unemployment. The cost of cutting in the United States continues substantially higher than in other diamond-cutting centers of the world. Half the cutters are Belgians. Conditions in the Netherlands' cutting industry were fairly satisfactory, with about 1,500 to 1,600 workers employed. The Israel diamond-cutting industry was beset by many problems, chiefly lack of supply of rough from the Diamond Syndicate. Cutting in Germany caused other diamond-cutting centers considerable difficulty. An effort is being made to revive the diamond-cutting industry in Cuba.

Imports.—Imports of gem-grade diamonds into the United States decreased from $100,645,415 (revised figure) in 1948 to $69,727,517 in 1949, a decrease of 31 percent. The dollar value of both rough and cut decreased, as did the quantity of both. Belgium furnished 47 percent (value) of the cut in 1949.

Diamonds (exclusive of industrial diamonds) imported for consumption in the United States, 1948–49, by countries

[U. S. Department of Commerce]

Country	Rough or uncut			Cut but unset		
	Carats	Value		Carats	Value	
		Total	Average		Total	Average
1948						
Austria				1	$215	$215.00
Belgian Congo	119	$3,870	$32.52			
Belgium				213,207	31,475,999	147.63
Brazil	[1] 12,987	[1] 235,410	[1] 18.13	4,762	578,774	121.54
British Guiana	786	29,219	37.17	116	12,535	108.06
Canada				21	13,388	637.52
China				328	67,032	204.37
Colombia				20	5,683	284.15
Cuba				4,790	657,520	137.27
Egypt				14	1,875	133.93
France				13,471	925,673	68.72
French Morocco				61	13,300	218.03
Germany				[1] 10,809	399,714	[1] 36.98
Hong Kong				324	83,282	257.04
Iran				113	12,724	112.60
Israel-Jordan	1,120	114,921	102.61	39,995	4,139,345	103.50
Italy				3	1,088	362.67
Jamaica				2	230	115.00
Japan				2	539	269.50
Lebanon				23	6,283	273.17
Mexico				80	9,954	124.43
Netherlands				34,246	5,109,945	149.21
Pakistan				1	488	488.00
Portugal				99	10,439	105.44
Sweden				1	450	450.00
Switzerland				18,298	3,044,693	166.39
Tangier				2	1,067	533.50
Thailand				1,049	197,868	188.63
Union of South Africa	832,022	42,379,244	50.94	33,060	7,974,210	241.20
U. S. S. R.				9,303	775,378	83.35
United Kingdom	6,112	310,098	50.74	4,297	724,968	168.71
Venezuela	56,725	1,327,719	23.41			
Yugoslavia				1	275	275.00
Total 1948	[1] 909,871	[1] 44,400,481	[1] 48.80	[1] 388,499	[1] 56,244,934	[1] 144.77
1949						
Argentina				3	1,009	336.33
Belgian Congo	3,100	6,096	1.97			
Belgium				159,189	19,581,847	123.01
Brazil	14,765	430,826	29.18	4,679	615,265	131.49
British Guiana	241	6,464	26.82	30	3,011	100.37
Canada				38	5,303	139.55
Chile				13	3,990	306.92
China				4	700	175.00
Cuba				580	71,096	122.58
Czechoslovakia				44	4,357	99.02
Denmark				139	11,300	81.29
France				2,843	355,889	125.18
French Morocco				63	15,091	239.54
Germany				3,528	283,903	80.47
Gold Coast	6,947	81,936	11.79			
Hong Kong				75	41,172	548.96
Iran				996	82,899	82.37
Israel-Jordan				70,485	5,402,074	76.64
Italy				27	134,933	4,997.52
Lebanon				103	13,829	134.26
Liberia	60	2,500	41.67			
Netherlands				24,789	3,202,237	129.18
Netherlands Antilles	11	3,534	321.27	15	3,689	245.93
Switzerland				14,465	1,932,944	133.63
Thailand				1,142	251,155	219.92
Union of South Africa	595,101	26,938,598	45.27	39,644	8,404,959	212.01
U. S. S. R.				8,663	539,412	62.27
United Kingdom	1,708	118,838	69.58	3,771	449,356	119.16
Venezuela	29,217	711,007	24.34	159	17,155	107.89
Total 1949	651,150	28,299,799	43.46	335,487	41,427,718	123.48

[1] Revised figure.

World Production.—Official figures on diamond production are not available for all countries, but the figures in the accompanying table are believed to be reasonably accurate as they have been compiled from Government reports, information supplied by officials of producing companies, and other authoritative sources. World production (gems and industrials) is estimated to have been 13,635,000 carats (3.01 short tons), which compares with 10,047,000 carats (2.21 short tons) for 1948, an increase for 1949 over 1948 of 36 percent.

Belgian Congo was the leading producer by weight but not by value since only about 7 percent of the Belgian Congo production is of gem quality. South Africa, on the other hand, although producing much less by weight led in terms of value.

Industrial Diamonds.—Sales of industrial diamonds in 1949 were very large, although considerably less than in 1948. Total sales in 1949 by Industrial Distributors (1946), Ltd., the industrial-diamond sales organization for the DeBeers group, were valued at £8,469,811. The United States purchased a large percentage of the total quantity, both for private industry and for the National Stockpile.

World production of diamonds, by countries, 1946–49, in metric carats

[Including industrial diamonds]

Country	1946	1947	1948	1949
Africa:				
Angola	806,961	799,210	795,509	769,981
Belgian Congo	6,033,452	5,474,469	5,824,567	9,649,896
French Equatorial Africa	87,381	107,076	118,800	123,000
French West Africa	51,834	53,749	77,970	94,996
Gold Coast	[1] 653,196	[1] 852,493	[2] 850,000	432,530
Sierra Leone	559,229	605,554	465,518	494,119
South-West Africa	163,611	179,554	200,691	280,134
Tanganyika	119,446	92,229	148,169	191,787
Union of South Africa:				
Lode	1,025,019	918,042	[2] 930,000	964,266
Alluvial	256,768	[3] 286,692	[2,3] 270,000	[3] 289,756
Total Union of South Africa	1,281,787	1,204,734	[2] 1,200,000	1,254,022
Brazil (estimated)	325,000	275,000	250,000	250,000
British Guiana	30,958	24,669	36,562	34,790
Venezuela	20,912	61,634	75,513	56,362
Other countries (estimated)	1,600	3,500	3,500	3,000
Grand total	10,135,000	9,734,000	10,047,000	13,635,000

[1] Exports.
[2] Estimated.
[3] Includes an estimate of 100,000 carats for State Mines of Namaqualand.

The use of diamond drills for exploring and breaking ore is expanding, and the use of diamond-impregnated wheels is increasing. The only significant new use of industrial diamonds is for drilling in oil fields. Bits up to 12 inches in diameter have been used, although the common sizes are 6- and 8-inch. These bits are being used not for core recovery but for "making hole."

Figure 1 shows the increase in the quantity of industrial diamonds imported into the United States in the past 27 years, as contrasted with the price per carat.

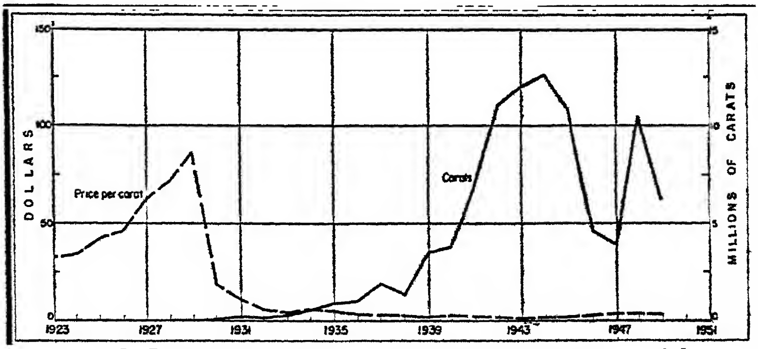

FIGURE 1.—United States imports and average price per carat of industrial diamonds, 1923–49.

Industrial diamonds (glaziers', engravers', and miners') imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Carats	Value		Year	Carats	Value	
		Total	Average			Total	Average
1945	10,733,411	$12,823,962	$1.19	1948 [1]	10,421,207	$32,581,385	$3.13
1946	4,625,282	14,297,536	3.09	1949	6,261,689	17,339,219	2.77
1947	3,999,119	13,312,668	3.33				

[1] Revised figures.

RUBY, SAPPHIRE, AND EMERALD

The precious stones, other than diamond, continued to increase in price owing to short supply of newly mined stones of fine quality.

A 2-ounce particolored sapphire was reported found along the bed of a gully near Tomahawk Creek, Central Queensland, Australia, a locality where gems had not been previously known to exist.

A star sapphire was found in a mine in the Ratnapura District, Ceylon, weighing nearly one-half pound. It is believed that two stones of about 400 carats each can be cut from it.

Mining has been resumed at the famous Chivor-Somondoco mines in Colombia according to reports. The old "terrace" type of mining has given way to conventional underground methods.[3] Production for 1949 was reported to be 91,656 carats compared with 82,370 carats for 1948.[4]

The emerald mines at Muzo, Colombia, have been closed by the Banco de la Republica, after operating for the year at a considerable loss.

Emeralds were mined in India, at Kaliguman, a small village in the Udaipur district in the State of Rajasthan. A small proportion of the production reportedly yielded stones of fine quality. Production of all qualities for 1948–49 was approximately 15,000 carats.

South Africa and Brazil continue to produce a few emeralds.

[3] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 1, January 1950, pp. 29–38.
[4] Bureau of Mines, Mineral Trade Notes: Vol. 31, No. 1, July 1950, pp. 31–32.

Ceylon produces not only ruby and sapphire but also alexandrite, cat's-eye, and a variety of less valuable gem stones. Most of these are recovered from gravels by placer mining. An estimated half million dollars' worth of gems is produced each year.

LESSER GEMS

The Australian opal-mining industry continues at a low ebb. Only about 100 miners are active. The once famous black-opal fields at Lightning Ridge, New South Wales, are almost exhausted.

Brazil continued to produce a large caratage of the lesser gems, principally amethyst, aquamarine, citrine quartz, and topaz.

TECHNOLOGY

Synthetic rutile (titania) was made in quantity by the Linde Air Products Co. and the National Lead Co. The material is grown in boules by a modification of the well-known Verneuil technique. No completely colorless material has been made, the nearest to this being tinged with yellow. Other shades such as red, blue, green, brown, and yellow have also been made. The refractive index of synthetic rutile is considerably higher than diamond, while its dispersion is approximately three times that of diamond.

Several experiments were reported in which the color of topaz, sapphire, and other gems was changed by exposure to radium radiation. The turning of yellow diamonds green and colorless quartz purple by bombardment in a cyclotron was also reported.

Education and Laboratories.—The Gem Trade Laboratory of New York consolidated with the Gemological Institute of America, the new laboratory to be known as the Gem Trade Laboratory of the Gemological Institute of America, 5 East Forty-seventh Street, New York, N. Y.

The Diamond Research Laboratory of Johannesburg, Union of South Africa, was established recently by the leading diamond companies of the world for two purposes: (1) To assist the mining companies in problems concerning their extraction processes and in investigations leading to increased output and reduced cost and (2) to act as a research and service center for all who use diamonds in any form.

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Gold and Silver

By Charles White Merrill and Helena M. Meyer

GENERAL SUMMARY

UNITED States mine production of gold in 1949 decreased 1 percent compared with 1948, continuing the downtrend from the postwar high established in 1947. The 1949 output was twice the wartime low reached in 1945 but was smaller than in any prewar year since 1895. Silver production also decreased, the 1949 output being 9 percent below that for 1948. The gold-mining industry had returned to unrestricted operations when War Production Board Order L–208 was rescinded, effective July 1, 1945; but many mines producing in prewar years did not resume work or did so on a restricted scale only. Higher prices for equipment and supplies and higher wages made former operators reluctant to reopen mines with narrow prewar profit margins. Continued inflation, with little evidence that inflationary forces soon would be arrested, discouraged those who might otherwise have promoted new gold-producing enterprises. Moreover, in many instances the years of idleness had resulted in deterioration of plants and mine workings, which required very large capital outlays for rehabilitation.

The reversal in 1949 of the postwar uptrend in silver production is explained largely by the recession in copper, lead, and zinc prices accompanied by curtailed output at mines producing these metals and byproduct silver. The higher Treasury buying price for silver domestically mined after July 1, 1946, continued to encourage silver mining.

California, which had been the leading gold producer since 1946 was forced into second place in 1949 by South Dakota, where output expanded 23 percent compared with 1948. These two States, plus Utah and Alaska in third and fourth places, respectively, supplied 72 percent of the United States total output. South Dakota output came almost entirely from gold ore produced at the Homestake mine, California production came principally from straight gold mines (both placer and lode), Utah production was mainly a byproduct from the treatment of copper ore mined in the West Mountain (Bingham) district, and Alaska gold was almost entirely from placers and was mostly recovered by bucket-line dredges. Idaho continued to be the leading silver producer, followed in importance by Utah and Montana, an order unchanged since 1943. These three States supplied 67 percent of the 1949 domestic output. About half of the Idaho production was recovered from dry ores, but most of the rest from the three States was a byproduct of ores treated principally for base metals.

Gold produced in 1949 was divided fairly evenly among that recovered at amalgamation-cyanidation mills, that recovered by the smelting of crude ores and concentrates (only a very small part of which was recovered by direct smelting of ore), and that saved by placer methods. Almost 87 percent of the domestic silver output was

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recovered by smelting concentrates and nearly all of the remainder by the direct smelting of ore.

Outside the United States, gold production rose about 5 percent. The slight over-all gain cannot be credited, as would be expected, to devaluation of currencies in many countries, because total production following devaluation in September was no greater than in several preceding months. Devaluation did tend to increase output in certain areas and doubtless will cause further gains in 1950; but the fact that some companies with limited hoisting or milling capacity, in terms of tonnage, grasped the opportunity to treat ores having a lower average gold content was a counterbalancing factor. World production of silver in 1949 was 4 percent less than in 1948. A drop of 14 percent in Mexican output more than offset smaller gains in Canada and elsewhere. Current gold and silver world-production rates are far below prewar averages.

Shaft sinking and continued exploratory drilling in the vicinity of Odendaalsrus, Orange Free State, 150 miles southwest of Johannesburg, brought this promising field nearer to production. In Canada, where output of gold had been stimulated by the subsidy program inaugurated in December 1947, bonuses at the end of 1949 were to be reduced $3.50 an ounce, the amount added to the value of gold as a result of the devaluation of the Canadian dollar in September 1949.

The pressure to reprice gold upward increased during 1949. As the exigencies of war had forced governments to limit the flow of gold and the conversion of foreign credits, black markets in gold developed in many parts of the world. The International Monetary Fund, in cognizance of such developments, expressed its disapproval in a statement issued by its Executive Board on June 18, 1947, as follows:

Exchange stability may be undermined by continued and increasing external purchases and sales of gold at prices which directly or indirectly produce exchange transactions at depreciated rates. From information at its disposal, the Fund believes that unless discouraged this practice is likely to become extensive, which would fundamentally disturb the exchange relationships among the members of the Fund. Moreover, these transactions involve a loss to monetary reserves, since much of the gold goes into private hoards rather than into central holdings. For these reasons, the Fund strongly deprecates international transactions in gold at premium prices and recommends that all of its members take effective action to prevent such transactions in gold with other countries or with nationals of other countries.

The Union of South Africa, however, took the position that gold producers were being required to make "disproportionate sacrifices" in the Fund's program for monetary and exchange stabilization. In September 1949, at the Fourth Annual Meeting of the Governors of the International Monetary Fund, the Governor for the Union of South Africa proposed the following resolution:

WHEREAS, it is the desire of all members of the International Monetary Fund to persevere in their endeavour to secure international co-operation in monetary and foreign exchange matters on the basis accepted by the Bretton Woods Conference, and

WHEREAS, it would be unreasonable to attempt to secure such co-operation on the basis of disproportionate sacrifice by members producing gold, and

WHEREAS, the price for gold used for monetary purposes in terms of Article IV, Section I, of the Articles of Agreement of the International Monetary Fund has remained unchanged since the inception of the Fund, and

WHEREAS, the prices of other commodities have in the meantime increased by substantial margins, and

WHEREAS, the maintenance of stable exchange rates is the reason for fixing the price of gold at the same figure over considerable periods of time, and

WHEREAS, the maintenance of the price at present fixed in terms of the Fund Agreement has, in the face of the substantial increase in the price-level of other commodities, only been secured at heavy, disproportionate and unjustifiable cost to countries producing gold, and

WHEREAS, it is permissible in terms of the Fund Agreement to sell newly-mined gold in any market.

SO THEREFORE, it is now Resolved by the Governors of the International Monetary Fund that nothing in the Articles of Agreement of the Fund shall be interpreted to prevent the sale, by the Government of any member, of newly-mined gold in any market at such premium prices as may be ruling in that market provided the said member sells to the Fund or to one or more members of the Fund, or transfers to its own monetary reserves at least fifty per cent of its newly-mined gold at the price from time to time current in terms of the Articles of Agreement of the Fund.

After study of the South African proposal and review of the Fund's 1947 statement of position, the Executive Board recommended on April 24, 1950 that the Board of Governors do not adopt the resolution of the Governor for the Union of South Africa.

The position expressed in the South African resolution had found wide support among domestic gold miners. Other United States interests, however, supported the Fund's position, in the belief that an increased quantity of gold available for hoarding would absorb funds, particularly in Economic Cooperation Administration countries, that otherwise would be available for foreign exchange support and for import of materials needed in economic rehabilitation. As a result, it was argued that the demands on the United States Government for grants and other support would be increased and in effect the United States would finance, in part at least, accumulation of gold in foreign privately held hoards.

The premiums paid by foreign hoarders for gold are difficult to determine. Much of the trade has been conducted in black markets and involved the violation of laws with attendant secrecy. In most markets the currency exchanged for gold was not freely exchangeable for United States dollars, and consequently quotations calculated in dollars were not necessarily realizable. During 1949 the premiums trended downward. For example, in the Paris free market bar gold was reported at $50 an ounce in May 1949, but a year later a similar quotation placed the price at $41.

A clarification of Treasury regulations promulgated under the Gold Reserve Act of 1934 governing the sale of gold with regard to transactions in unprocessed or "natural" gold came late in 1948. The legality of domestic trade and holding of "natural" gold, under section 19 of the Provisional Regulations issued under the act, was established in these terms:

> Gold in its natural state may be acquired, transported within the United States * * * without the necessity of holding a license therefor.

As a result, much publicity was given in 1948 and 1949 to the possibilities of producers developing a premium market for their product among hoarders preferring gold to currency and speculators anticipating a rising price for the metal. Production that could qualify as "natural" gold suitable for trading was limited. Most placer gold was disqualified because of amalgamation during recovery—neither

amalgam nor sponge gold was termed "natural." Some placer gold is recovered without mercury, and some operators could recover a "natural" gold product with a very small change in the washing methods. In addition to "natural" gold recovered from gravels, a few lode-mine operators found it practicable to recover from their ores free gold that would qualify as "natural" gold.

A special canvass was made of 1948 gold producers to determine the quantity of "natural" gold sold at premium prices and the total amount of the premiums. A similar canvass was made for 1949 data. Most of the gold producers reported no such sales in either year. Not all those reporting were willing to furnish data on quantities sold and premiums received. However, it is estimated that domestic "natural" gold containing 29,000 fine ounces of gold reached the premium market in 1949 compared with an estimated 25,000 fine ounces in 1948. In 1949 approximately three-quarters of the metal was mined in Alaska, but substantial sales of California and Montana material were made. Although rumors of high premiums continued to circulate, an extensive field check indicated the premium price to have averaged between $39 and $40 in 1949 compared to reports of substantial sales up to $43 or a little higher in 1948. The premium market appeared to have grown less attractive to producers toward the end of 1949. One large producer reporting over 3,000 fine ounces on hand at the end of the year stated that provision for collecting gold in its "natural" state was being discontinued. Mint receipts in early 1950 included a disproportionate quantity reported as having been recovered in 1949, indicating that some producers were accepting the Treasury price for gold they had been holding for the premium market. Probably some gold remained in the hands of producers when the canvass on which this chapter's domestic production statistics are based was closed. Such gold as is reported will be credited to the output of subsequent years. The quantities that may be involved will be very small compared with current production.

To facilitate the "natural" gold trade, methods have been devised for packaging and providing acceptable assays of lot fineness. The use of sealed-leather pokes and the casting of predetermined quantities of gold dust of known fineness in transparent plastic blocks were reported among the methods of preparing suitable hoarding and trading units. At least one large New York brokerage firm dealing in securities and commodities provided a standard contract for the sale and delivery of gold.

The United States Treasury buying price for gold throughout 1949 continued at $35 per fine ounce.

International trade in silver was dominated by the regulations of various governments. The United States Treasury continued to purchase silver mined domestically after July 1, 1946, at $0.9050505+ per fine ounce, a price substantially above the New York price for metal that could not qualify for Treasury acceptance. Import duties imposed in India resulted in the Bombay silver market operating almost completely on an internal basis. The New York market experienced an even greater degree of stability during 1949 than in 1948, with a range from a low of $0.7025 to a high of $0.7350 per ounce of silver 0.999 fine in 1949 compared with $0.7025 and $0.7775, respectively, in 1948.

Salient statistics of gold and silver in the United States,[1] 1940–44 (average) and 1945–49

	1940–44 (average)	1945	1946	1947	1948	1949
Mine production, fine ounces:						
Gold	3,088,027	954,572	1,574,505	2,109,185	2,014,257	1,991,783
Silver	53,501,924	29,024,197	22,914,604	35,823,563	38,096,031	34,674,952
Ore (dry and siliceous) produced (short tons):						
Gold ore	9,377,189	1,364,308	2,395,500	3,523,715	3,261,194	3,370,139
Gold-silver ore	895,555	276,530	389,681	366,454	569,760	412,378
Silver ore	841,280	343,458	209,626	344,649	370,647	476,960
Percentage derived from—						
Dry and siliceous ores:						
Gold	51	30	40	39	39	45
Silver	35	24	24	26	27	24
Base-metal ores:						
Gold	21	51	23	29	31	28
Silver	65	76	75	74	73	76
Placers:						
Gold	28	19	37	32	30	27
Silver	(2)	(2)	(2)	(2)	(2)	(2)
Net industrial consumption:						
Gold	$56,248,819	$108,944,332	$153,687,000	$48,900,000	$44,986,000	$108,842,471
Silver, fine ounces	91,285,983	126,300,000	87,000,000	98,500,000	105,289,000	88,000,000
Imports:						
Gold	$1,252,663,610	$93,718,050	$532,961,768	$2,079,588,406	$1,981,175,178	$771,390,261
Silver	$39,573,285	$27,278,396	$57,577,888	$68,140,343	$70,884,513	$73,535,694
Exports:						
Gold	$199,448,763	$199,967,940	$221,467,636	$213,240,800	$300,771,144	$84,935,678
Silver	$33,790,395	$90,936,901	$36,454,690	$30,648,742	$12,400,060	$23,281,043
Monetary stocks:[3]						
Gold		$20,065,000,000	$20,529,000,000	$22,754,000,000	$24,244,000,000	$24,427,000,000
Silver, fine ounces		2,005,000,000	1,951,000,000	1,953,000,000	1,952,000,000	1,978,000,000
Price, average, per fine ounce:						
Gold	$35.00	$35.00	$35.00	$35.00	$35.00	$35.00
Silver	$0.711+	$0.711+	$0.808	$0.905	$0.905	$0.905
World production, fine ounces (estimated):						
Gold	34,746,000	26,100,000	27,600,000	28,900,000	29,700,000	30,600,000
Silver	235,351,000	162,000,000	135,000,000	167,700,000	172,000,000	164,500,000

[1] Philippine Islands and Puerto Rico excluded.
[2] Less than 0.5 percent.
[3] Owned by Treasury Department; privately held coinage not included.

Silver consumed for coinage, particularly for China, Saudi Arabia, Mexico, Sweden, and the United States, totaled close to 70,000,000 ounces in 1949 and greatly exceeded the quantities returning to the world markets for demonitization programs. This was a marked net gain in coinage absorption over 1948, and was made despite the cutting in half of the quantity used in the United States for this purpose.

The net inflow of gold, reestablished in 1946 after a period when war expenditures had depleted United States holdings, increased in volume in 1947 and continued nearly unabated in 1948; it dropped to 41 percent of the 1948 total in 1949. Recent gains resulted in the establishment of new all-time monthly highs in United States stocks from January 1948 until the end of August 1949, following which stocks dropped slightly but, nonetheless, remained close to peak levels through the remainder of the year. Likewise, the net inflow of silver was resumed in 1946, increased in 1947 and 1948, but dropped 14 percent in 1949.

DOMESTIC PRODUCTION

Production of gold and silver in the United States is measured at mines and refineries. Both measures are tabulated by States of origin, but there is a small annual variation between them explained largely by time lag. Over a period of years, the deviations are found to be negligible. Compared with the mine reports compiled by the Bureau of Mines, the refinery reports compiled by the Bureau of the Mint in cooperation with the Bureau of Mines for the 45 years, 1905–49, show a total excess of gold of 184,363 ounces (a difference of 0.12 percent) and a total excess of silver of 15,832,478 ounces (a difference of 0.65 percent).

Gold and silver produced in the United States, 1905–49, in fine ounces, according to mine and mint returns, in terms of recoverable metals

Year	Mine		Mint	
	Gold	Silver	Gold	Silver
1905–44	142,725,645	2,286,938,209	143,063,806	2,300,377,419
1945	968,062	29,024,197	928,893	29,063,255
1946	1,574,505	22,914,604	1,462,354	21,103,269
1947	2,109,185	35,823,563	2,165,318	38,587,069
1948	2,014,257	38,096,031	2,025,480	39,228,468
1949	1,991,783	34,674,952	1,921,949	34,944,554
Total 1905–49	151,383,437	2,447,471,556	151,567,800	2,463,304,034

MINE PRODUCTION

During the war years 1943–45, for the first time on record, over half of the domestic gold output was recovered from base-metal ores, but in the years since both dry ores and placer gravels exceeded base-metal ores in yield of gold. This recovery in gold mining, however, has not restored the industry to its prewar level. High wages, difficulties in recruiting labor forces, and high prices for equipment and supplies, together with an unchanged gold price, retarded recovery. In 1949 the slight downtrend begun in 1948 was continued, and production amounted to 41 percent of the all-time peak established in 1940.

Silver production, which had declined without interruption from 1940 to 1946, reversed the trend in 1947 and by 1948 was 66 percent

above the 1946 low. Output in 1949, however, fell 9 percent compared with 1948. An analysis of silver production, by ores, shows that approximately three-fourths was recovered as a byproduct from base-metal ores from 1945 to 1949. Moreover, all of the silver recovered at placers and part of that produced from dry ores were byproducts of operations carried on chiefly for gold.

All tonnage figures used in this report are short tons of 2,000 pounds "dry weight"; that is, they do not include moisture. Figures in cubic yards used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before excavation. The weight unit for gold and silver is the troy ounce (480 grains). The totals are calculated upon the basis of recovered and recoverable fine gold and silver shown by assays to be contained in ore, bullion, and other material produced.

Mine production of gold and silver in the United States, in 1949, by months, in fine ounces

	Gold	Silver		Gold	Silver
January	104,711	2,595,454	August	190,281	2,963,793
February	116,572	2,758,252	September	188,884	2,218,651
March	153,944	3,486,049	October	213,250	2,100,129
April	159,075	3,505,652	November	181,497	2,529,944
May	158,050	3,606,282	December	187,547	3,158,925
June	169,319	3,065,486			
July	168,653	2,686,335	Total	1,991,783	34,674,952

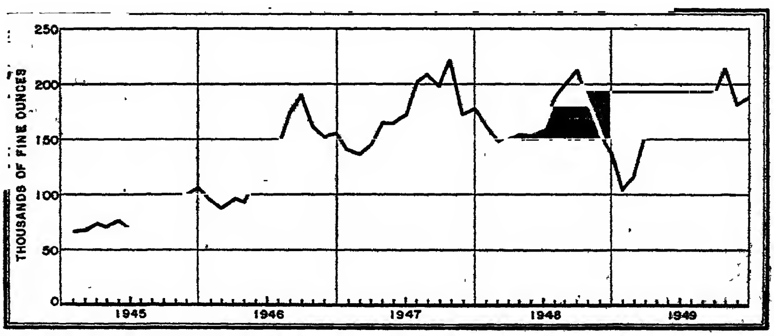

FIGURE 1.—Mine production of gold in the United States, 1945–49, by months, in terms of recoverable gold.

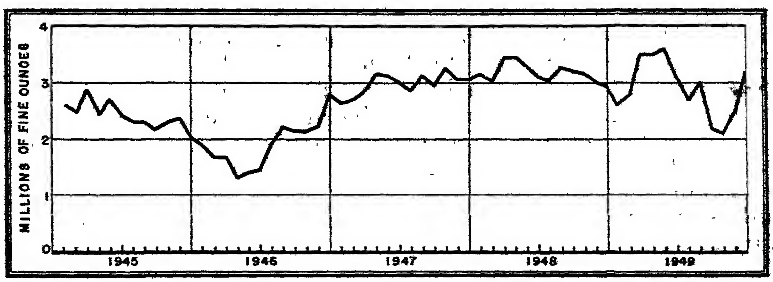

FIGURE 2.—Mine production of silver in the United States, 1945–49, by months, in terms of recoverable silver.

Mines are grouped into two main classes—placers and lodes. The placers are those in which gold and silver as native metals or in natural alloy and, in a few placers, platinum are recovered from gravel. Except for such small-scale hand methods as those utilizing the gold pan, the rocker, or the dry washer, all placer recovery methods employ sluice boxes; methods are distinguished by the means used for delivering the gravel to the sluices. Those methods where gravel is delivered mechanically include bucket-line dredging, drag-line dredging, and treatment in nonfloating washing plants of gravel delivered by power shovel, drag-line excavator, truck, slack-line scraper, or other mechanical means. In the hydraulic method the gravel is mined from the bank by a powerful jet of water; in some small-scale hand methods the gravel is shoveled into sluices; and in drift operations the gravel is mined underground and delivered to sluices at the surface. The lode mines are those yielding gold and silver from ore (as distinguished from gravel), mainly from underground workings and, in addition to those worked chiefly for one or both of the precious metals, include those that yield ore mined chiefly for copper, lead, zinc, or other metals but contribute the precious metals as byproducts. As far as possible, the mine unit used is not the operator but the mining claim or group of claims.

Principal Mining Districts and Leading Mines

One of the anomalies of the war economy was the emergence of a copper district—West Mountain (Bingham), Utah—as the leading gold producer in the United States, surpassing Lawrence County (Lead), S. Dak., in 1943, 1944, and 1945. In 1946, however, Lawrence County regained the lead, a position held through 1949; the West Mountain district has ranked second in this period. Half of the domestic mine output was mined in the four leading districts in 1949. Among the first four districts is the Yukon River Basin, Alaska, with 151,262 ounces in 1949 and 189,143 ounces in 1948.

The leading silver districts for many years have included many noted more for base-metal output than for silver yield, and this condition was unchanged in 1949. The three leading districts produced more than half of the total United States output of silver in 1949.

Of the 25 leading gold-producing mines, 8 were lode gold mines, 6 were placers worked by bucket-line dredges, 3 were copper mines, 1 was a lead-zinc mine, and 1 was a copper-zinc mine; 6 produced more than 1 type of ore. The 3 leading mines contributed 41 percent of the total gold produced in the United States in 1949 and the 25 on the list, 73 percent.

Only 3 of the 25 leading silver-producing mines depended exclusively on silver ore; ores valuable chiefly for copper, lead, zinc, and gold supplied most of the silver production. The seven leading mines each producing over 1,000,000 ounces of silver in 1949 contributed 46 percent of the United States total. The list of 25 mines supplied over two-thirds of the United States output. As several operators worked more than one of the leading silver mines as well as smaller producers, the output of silver by companies was substantially more concentrated than by mines.

Mine production of recoverable gold in the United States, 1940–44 (average), by districts that produced 10,000 fine ounces or more during any year, 1945–49, in fine ounces [1]

District or region	State	1940–44 (average)	1945	1946	1947	1948	1949
Lawrence County	South Dakota	363,807	55,947	312,246	407,192	377,836	464,650
West Mountain (Bingham)	Utah	302,996	248,923	140,877	384,414	332,588	286,155
Grass Valley-Nevada City	California	(2)	31,064	49,033	68,383	94,398	(2)
Folsom	do	85,092	32,851	93,718	102,121	104,196	98,435
Yuba River	do	(2)	(2)	(2)	(2)	(2)	(2)
Yellow Pine	Idaho	7,497	4,862	10,842	31,006	27,158	53,576
Chelan Lake	Washington	42,767	40,207	32,353	12,024	41,826	(2)
Robinson (Ely)	Nevada	63,410	45,063	39,234	39,490	37,453	38,703
Ajo	Arizona	38,354	24,772	33,083	30,477	38,647	38,455
Upper San Miguel	Colorado	22,483	17,779	24,648	38,155	38,188	35,217
Republic (Eureka)	Washington	24,850	17,363	18,563	22,590	28,196	23,751
Oroville	California	39,936	4,217	17,891	22,589	20,800	22,701
Mother Lode	do	103,392	5,126	7,271	9,020	(2)	21,948
Potosi	Nevada	(2)	10,752	17	----------	----------	(2)
Park City Region	Utah	18,938	13,822	16,956	17,052	19,087	19,443
Comstock	Nevada	26,158	661	5,419	5,028	11,591	18,540
California (Leadville)	Colorado	19,594	15,706	10,749	(2)	(2)	(2)
Bullion	Nevada	5,329	----------	12,473	17,058	16,676	16,791
Summit Valley (Butte)	Montana	18,588	12,052	6,882	19,777	19,163	15,742
Big Bug	Arizona	9,073	8,395	8,629	9,720	11,058	14,035
Cripple Creek	Colorado	88,570	28,524	47,640	58,158	53,569	13,460
Pioneer (Superior)	Arizona	9,727	5,007	7,260	9,339	10,054	12,839
Snelling	California	23,033	(2)	3,732	(2)	(2)	(2)
Warren (Bisbee)	Arizona	55,805	15,863	5,680	20,131	19,083	11,837
Verde (Jerome)	do	22,373	8,602	8,132	6,931	11,374	10,790
Animas	Colorado	19,771	21,870	15,905	18,496	13,428	10,658
Alleghany	California	(2)	(2)	8,477	7,779	(2)	(2)
La Grange	do	12,317	7,544	(2)	(2)	(2)	(2)
Fairplay	Colorado	5,040	7,338	(2)	(2)	8,489	(2)
Cosumnes River	California	15,497	389	(2)	10,691	13,956	(2)
Camanche	do	(2)	(2)	13,933	9,229	(2)	(2)
Tintic	Utah	24,086	14,536	17,799	15,385	11,007	5,133
Boise Basin	Idaho	12,564	1,858	7,758	7,894	11,732	4,789
Klamath River	California	18,439	(2)	5,853	11,295	5,033	2,584
Manhattan	Nevada	20,274	9,870	13,478	1,618	782	1,031
Sheepeater	Montana	4,919	7,812	9,822	10,140	6,498	----------

[1] Exclusive of Alaska.
[2] Bureau of Mines not at liberty to publish figure.

Mine production of recoverable silver in the United States, 1940–44 (average), by districts and regions that produced 200,000 fine ounces or more during any year, 1945–49

District or region	State	1940–44 (average)	1945	1946	1947	1948	1949
Coeur d'Alene region	Idaho	12,448,941	7,115,646	5,655,672	9,234,906	10,598,338	9,146,146
Summit Valley (Butte)	Montana	7,661,055	4,936,770	2,417,422	5,251,095	6,099,790	5,635,101
West Mountain (Bingham)	Utah	5,017,542	3,628,229	2,030,182	4,816,611	4,694,674	4,316,378
Warren (Bisbee)	Arizona	2,278,187	963,180	721,135	1,522,558	1,432,172	1,166,210
Park City region	Utah	2,533,527	1,033,830	1,009,422	1,352,748	1,703,864	1,061,902
Tintic	do	2,069,900	1,086,435	619,724	1,076,726	1,123,460	914,150
Pioche	Nevada	580,761	350,259	403,358	426,229	684,321	708,216
Copper Mountain (Morenci)	Arizona	143,042	345,863	265,151	540,232	605,153	606,111
Big Bug	do	265,875	320,559	338,062	386,452	425,079	581,351
Upper San Miguel	Colorado	305,885	274,559	355,604	392,540	526,742	579,498
Animas	do	354,580	301,957	339,088	362,888	417,887	539,402
Verde (Jerome)	Arizona	1,169,237	475,290	418,578	367,778	408,669	509,828
Ajo	do	412,073	285,719	390,401	353,789	455,411	471,134
Warm Springs	Idaho	715,567	460,357	418,599	427,242	266,226	468,302
Pioneer (Superior)	Arizona	664,589	251,062	243,667	314,126	308,448	401,202
Coso (Darwin)	California	90,222	575,069	871,091	1,093,709	393,761	352,482
Creede	Colorado	745,486	433,177	355,110	317,712	297,926	263,867
Ten Mile	do	22,250	67,223	88,995	106,481	271,944	254,294
Pima (Sierritas, Papago, Twin Buttes)	Arizona	41,601	137,503	125,125	143,653	162,224	252,334
Comstock	Nevada	299,465	4,646	50,854	68,621	176,882	233,705
Rush Valley	Utah	(1)	(1)	(1)	(1)	(1)	(1)
California (Leadville)	Colorado	260,874	417,427	332,024	(1)	(1)	(1)
Red Cliff	do	2,364,938	49,171	57,353	233,351	416,032	216,580
Harshaw	Arizona	290,311	144,841	105,672	168,800	210,533	140,011
Central	New Mexico	315,993	(1)	(1)	167,538	(1)	(1)
Yellow Pine	Idaho	85,742	42,909	78,094	255,043	236,031	92,439
Bayhorse	do	218,146	200,631	84,052	204,264	166,246	87,130
Virginia City	Montana	19,964	86,175	236,318	96,515	225,784	84,918
Flint Creek	do	388,592	208,260	10,255	173,716	31,858	15,040

[1] Bureau of Mines not at liberty to publish figure.

Twenty-five leading gold-producing mines in the United States in 1949, in order of output

Rank	Mine	District	State	Operator	Source of gold
1	Homestake	Whitewood	South Dakota	Homestake Mining Co.	Gold ore.
2	Utah Copper	West Mountain (Bingham)	Utah	Kennecott Copper Corp.	Copper ore.
3	Fairbanks Unit	Fairbanks	Alaska	U. S. Smelting, Refining & Mining Co.	Dredge.
4	Natomas	Folsom	California	Natomas Co.	Do.
5	New Brunswick-Idaho-Maryland	Grass Valley-Nevada City	do	Idaho Maryland Mines Corp.	Gold ore.
6	Yuba Unit	Yuba River	do	Yuba Consolidated Gold Fields	Dredge.
7	Yellow Pine	Yellow Pine	Idaho	Bradley Mining Co.	Gold, gold-antimony ores.

8	Empire Star group	Grass Valley-Nevada City	California	Empire Star Mines, Ltd	Gold ore.
9	Holden	Chelan Lake	Washington	Howe Sound Co	Zinc-copper ore.
10	New Cornelia	Ajo	Arizona	Phelps Dodge Corp	Copper ore.
11	Ruth & Copper Flat	Robinson (Ely)	Nevada	Kennecott Copper Corp	Do.
12	Nome	Nome	Alaska	U. S. Smelting, Refining & Mining Co.	Dredge.
13	Smuggler-Union, etc	Upper San Miguel	Colorado	Telluride Mines, Inc	Gold ore.
14	Knob Hill	Republic (Eureka)	Washington	Knob Hill Mines, Inc	Do.
15	Getchell & Pinson-Ogee	Potosi	Nevada	Getchell Mines, Inc	Do.
16	Capital Dredges	Folsom	California	Capital Dredging Co	Dredge.
17	Old Eureka	Mother Lode	do	Central Eureka Mining Co	Gold ore.
18	United States & Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Zinc-lead, gold-silver, silver ores.
19	Goldacres	Bullion	Nevada	London Extension Mining Co	Gold ore.
20	Butte Unit	Oroville	California	Yuba Consolidated Gold Fields	Dredge.
21	Park Galena-Mayflower	Park City	Utah	New Park Mining Co	Zinc-lead ore.
22	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper, zinc-lead ores.
23	Iron King & Ext	Big Bug	Arizona	Shattuck Denn Mining Co	Zinc-lead, gold-silver, gold ores.
24	Treasury Tunnel-Black Bear	Upper San Miguel	Colorado	Idarado Mining Co	Zinc-lead-copper ore.
25	Magma	Pioneer (Superior)	Arizona	Magma Copper Co	Copper, silver ores.

Twenty-five leading silver-producing mines in the United States in 1949, in order of output

Rank	Mine	District	State	Operator	Source of silver
1	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper, zinc-lead ores.
2	Sunshine	Evolution	Idaho	Sunshine Mining Co	Silver ore.
3	Utah Copper	West Mountain (Bingham)	Utah	Kennecott Copper Corp	Copper ore.
4	United States & Lark	do	do	U. S. Smelting, Refining & Mining Co	Zinc-lead, gold-silver, silver ores.
5	Bunker Hill & Sullivan	Yreka	Idaho	Bunker Hill & Sullivan Mining & Concentrating Co.	Zinc-lead ore.
6	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp	Copper, zinc-lead ores.
7	Polaris	Evolution	Idaho	Sunshine Mining Co	Silver ore.
8	Chief, etc	Tintic	Utah	Chief Consolidated Mining Co	Zinc-lead, lead, silver ores.
9	Morenci	Copper Mountain	Arizona	Phelps Dodge Corp	Copper ore.
10	Page	Yreka	Idaho	Federal Mining & Smelting Co	Zinc-lead ore.
11	Iron King & Ext	Big Bug	Arizona	Shattuck Denn Mining Corp	Zinc-lead, gold, gold-silver ores.
12	St. Germain-Purim	Evolution	Idaho	Silver Dollar Mining Co	Lead ore.
13	Pioche group	Pioche	Nevada	Combined Metals Reduction Co	Zinc-lead ore.
14	United Verde	Verde (Jerome)	Arizona	Phelps Dodge Corp	Copper, zinc-copper ores.
15	New Cornelia	Ajo	do	do	Copper ore.
16	Triumph	Warm Springs	Idaho	Triumph Mining Co	Zinc-lead ore.
17	Treasury Tunnel-Black Bear	Upper San Miguel	Colorado	Idarado Mining Co	Zinc-lead-copper ore.
18	Shenandoah, etc	Animas	do	Shenandoah-Dives Mining Co	Gold-silver ore.
19	Magma	Pioneer (Superior)	Arizona	Magma Copper Co	Copper, silver ores.
20	Darwin group	Coso (Darwin)	California	Anaconda Copper Mining Co	Zinc-lead ore.
21	Park Galena-Mayflower	Park City	Utah	New Park Mining Co	Do.
22	Sherman	Lelande	Idaho	Day Mines, Inc	Lead ore.
23	Butterfield	West Mountain (Bingham)	Utah	Combined Metals Reduction Co	Zinc-lead ore.
24	Amethyst, etc	Creede	Colorado	Emperius Mining Co	Silver ore.
25	Emma	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Zinc-lead ore.

Mine production of recoverable gold in the United States, 1939–49, with production of maximum year, and cumulative production from earliest record to end of 1949, by States, in fine ounces

	Maximum production [1]		Production by years											Total production from earliest record to end of 1949
	Year	Quantity	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	
Western States and Alaska:														
Alaska	1906	1,066,030	676,737	755,970	695,467	487,621	99,583	49,296	68,117	226,781	279,988	248,395	229,416	26,841,227
Arizona	1937	332,694	316,453	294,807	315,392	253,651	171,810	112,162	77,223	79,024	95,860	109,487	108,993	11,182,499
California	1852	3,932,631	1,435,264	1,455,671	1,408,793	847,997	148,328	117,373	147,938	356,824	431,415	421,473	417,231	103,151,338
Colorado	1900	1,391,364	366,852	367,336	380,029	268,627	137,558	111,455	100,935	142,613	168,279	154,802	102,618	39,483,642
Idaho	1871	212,850	116,662	146,480	149,816	95,020	30,808	25,008	17,780	42,975	64,982	58,454	77,829	8,042,014
Montana	1865	870,750	264,173	272,602	246,475	146,892	59,586	50,021	44,597	70,507	90,124	73,091	52,724	17,268,060
Nevada	1910	913,265	361,518	383,983	366,403	295,112	144,442	119,056	92,265	90,680	89,063	111,532	130,399	25,847,995
New Mexico	1915	70,681	36,979	35,943	27,845	11,961	5,563	6,918	5,604	4,009	3,146	3,414	3,249	2,192,644
Oregon	1940	113,402	93,372	113,402	96,565	46,233	1,097	1,369	4,467	17,598	18,979	14,611	16,226	5,741,368
South Dakota	1939	618,536	618,536	586,662	600,637	522,098	106,444	11,621	55,948	312,247	407,194	377,850	464,650	22,295,995
Texas	1929	1,279	324	312	306	236	4			9	45	57	40	8,432
Utah	1947	421,662	277,751	355,494	356,501	391,544	390,470	344,223	279,979	178,533	421,662	368,422	314,058	11,747,120
Washington	1939	90,420	90,420	82,136	84,176	75,396	65,244	47,277	57,860	51,168	34,965	70,075	71,994	2,355,704
Wyoming	1869	7,498	583	740	478	23		20	2	105	1,486	115	389	80,031
Total			4,655,624	4,851,488	4,728,883	3,442,411	1,360,937	995,799	952,715	1,573,073	2,107,188	2,011,778	1,989,816	276,238,069
West Central States: Missouri	1900	33												33
States east of the Mississippi:														
Alabama	1936	4,726	3	5	30	1			5	1				49,495
Georgia	1882	12,094	670	961	311	30	12	5		21	76	19	18	870,060
Indiana	(2)	(2)	4	5										(3)
Maryland	1937	1,040	71											6,102
Michigan	1890	4,354												33,297
North Carolina	1887	10,884	495	1,943	3,244	4,077	131	21					13	1,164,601
Pennsylvania	1942	2,499	1,815	1,840	2,422	2,499	2,218	2,115	1,588	1,150	1,518	2,200	1,645	[4] 30,647
South Carolina	1941	15,508	13,833	13,076	15,508	7,824	147							318,801
Tennessee	1930	696	163	173	227	159	303	222	148	95	303	156	171	21,595
Vermont	1946	165					17	100	104	165	100	104	120	[5] 743
Virginia	1938	2,943	364	458	240	109	50	132	12					167,558
Total			17,418	18,461	21,982	14,699	2,878	2,595	1,857	1,432	1,997	2,479	1,967	2,663,499
Grand total			4,673,042	4,869,949	4,750,865	3,457,110	1,363,815	998,394	954,572	1,574,505	2,109,185	2,014,257	1,991,783	278,901,601

[1] For Central and Eastern States figures are peaks since 1880, except Pennsylvania and Vermont, for which the figures are peaks since 1905. For Alaska, Nevada, and Oregon figures are likewise peaks since 1880 only.
[2] Figure not available.
[3] Small; figure not available.
[4] 1908–49 only.
[5] 1905–49 only.

Mine production of recoverable silver in the United States, 1939–49, with production of maximum year, and cumulative production from earliest record to end of 1949, by States, in fine ounces

	Maximum production[1]		Production by years											Total production from earliest record to end of 1949
	Year	Quantity	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	
Western States and Alaska:														
Alaska	1916	1,379,171	201,054	191,679	191,522	119,704	42,788	13,362	9,983	41,793	66,150	67,341	36,056	19,959,845
Arizona	1937	9,422,552	7,824,004	7,075,215	7,498,260	7,064,467	5,713,889	4,394,039	3,558,216	3,268,765	4,569,084	4,837,740	4,970,736	307,064,974
California	1921	8,629,223	2,599,139	2,359,776	2,154,188	1,450,440	609,075	778,936	986,798	1,342,651	1,597,442	724,771	783,880	111,306,181
Colorado	1893	25,838,600	8,496,488	9,710,709	7,301,697	3,096,211	2,664,142	2,248,830	2,226,780	2,240,151	2,557,653	3,011,011	2,894,886	738,890,228
Idaho	1937	19,587,766	17,222,370	17,552,240	16,672,410	14,644,890	11,700,180	9,931,614	8,142,667	6,491,104	10,345,779	11,448,875	10,049,257	552,329,323
Montana	1892	19,038,800	9,087,571	12,361,050	12,386,925	11,188,118	8,450,370	7,093,215	5,942,070	3,273,140	6,326,190	6,930,716	6,327,025	768,733,754
Nevada	1913	16,090,083	4,316,029	5,175,928	5,830,238	3,723,435	1,620,280	1,259,636	1,043,380	1,250,651	1,377,579	1,790,020	1,800,209	594,571,520
New Mexico	1885	2,343,800	1,400,878	1,407,839	1,328,317	676,170	463,583	535,275	465,127	338,000	515,833	537,674	380,855	69,189,093
Oregon	1941	276,158	105,388	219,112	276,158	87,376	10,523	20,243	10,461	6,927	30,379	13,596	12,195	5,281,482
South Dakota	1900	536,200	167,584	175,514	170,771	186,937	35,886	5,445	26,564	86,901	111,684	94,693	109,383	10,003,769
Texas	1938	1,433,008	1,341,945	1,326,150	1,096,027	672,781	10,284	5,355	23,265	42,922	20,547	3,065	2,691	33,294,666
Utah	1925	21,276,689	10,758,657	12,172,299	11,395,485	10,574,955	9,479,340	7,593,075	6,106,545	4,118,453	7,780,032	8,045,329	6,724,880	741,722,760
Washington	1902	721,450	442,063	365,175	402,030	369,038	370,440	321,608	281,444	264,453	293,736	375,831	357,853	13,857,293
Wyoming	1901	21,400	75	114	94	52		3	31	28	95	11	21	74,819
Total			63,963,245	70,092,800	66,704,122	53,854,574	41,170,780	34,200,636	28,823,331	22,765,937	35,592,183	37,880,673	34,449,927	3,966,279,707
West Central States: Missouri	1938	292,000	218,400	147,306	169,027	69,106	111,285	92,243	94,822	69,401	93,600	114,187	123,413	4,493,197
States east of the Mississippi:														
Alabama	1936	869		3	3				1					5,239
Georgia	1904	1,500	58	630	38	7					13	3		10,963
Illinois	1924	8,891	675	4,766	8,138	104	2,153	2,437	2,198	2,302	1,790	4,047	3,128	146,307
Maryland	1917	1,092	2											2,595
Michigan	1916	716,640	101,878	88,657	60,796	61,674	48,479	54,218	21,863		3,089			10,256,112
New York	1937	41,500	37,250	35,720	37,734	40,012	38,004	25,238	14,271	15,786	22,409	18,788	18,378	448,697
North Carolina	1906	30,769	3,961	6,480	7,439	8,259	7,169	1,461						357,223
Pennsylvania	1942	15,501	13,558	13,064	15,016	15,501	13,095	13,545	10,434	7,887	9,863	13,731	10,827	215,975
South Carolina	1940	8,047	5,480	8,047	6,525	5,064	135							35,325
Tennessee	1920	110,719	31,994	38,610	39,161	34,671	52,058	45,907	35,391	18,016	79,147	39,692	41,833	3,199,022
Vermont	1946	35,275					2,721	18,862	20,586	35,275	21,469	24,910	27,446	[2] 177,877
Virginia	1944	18,993	1,780	271	135	1,793	14,947	18,993	1,300					79,389
Total			196,636	196,248	174,985	167,085	178,761	180,661	106,044	79,266	137,780	101,171	101,612	14,934,724
Grand total			64,373,281	70,436,354	67,048,134	54,090,765	41,460,826	34,473,540	29,024,197	22,914,604	35,823,563	38,096,031	34,674,952	3,985,707,628

[1] States east of the Mississippi figures are peaks since 1896, except New York and Pennsylvania which are peaks since 1905. The Illinois figure is the peak since 1907. Alaska, California, Nevada, and Oregon are peaks since 1880.
[2] Includes a small quantity by New Hampshire.

Ore Production, Classification, Metal Yield, and Methods of Recovery

The following tables give details of classes of ore, metal yield in fine ounces of gold and silver to the ton, and gold and silver output by classes of ore and by methods of recovery, embracing all ores that yielded gold and silver in the United States in 1949. These tables were compiled from the individual State chapters in this volume, in which more detailed data are presented.

The classification originally adopted in 1905 on the basis of smelter terminology, smelter settlement contracts, and metal recovery has been used continuously in succeeding years, except for modifications necessitated by the improvement in metallurgy and the lowering of the grade of complex ores treated. The copper ores include those smelting ores that contain 2.5 percent dry assay or more of copper (or less than this percentage if no other metal is present); or those ores concentrated chiefly for their copper content. The lead ores are those that contain 5 percent dry assay (minimum lead smelting charge requires 7.5 to 8.5 percent wet assay) or more of lead, irrespective of precious-metal content; and ore that carries any grade of lead exclusively is called a lead ore. Zinc smelting ores (chiefly oxides) had ranged from 16 to 45 percent zinc, but with the development of slag fuming, which permits some oxidized ore in the charge, and with high zinc prices, the minimum has declined to as low as 5 percent recoverable zinc; zinc concentrating ores include any grade of zinc ore that makes marketable zinc concentrate, irrespective of precious-metal content. The mixed ores are combinations of those enumerated.

Ore produced in the United States and average recovery, in fine ounces, of gold and silver per ton in 1949 [1]

State	Gold ore			Gold-silver ore			Silver ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States and Alaska:									
Alaska	76,739	0.104	0.018						
Arizona	4,567	.477	1.567	687	0.290	10.041	33,713	0.021	9.321
California	374,481	.432	.158	2,305	.168	6.037	2,141	.003	2.859
Colorado	215,357	.183	.823	224,999	.053	2.466	66,518	.017	6.693
Idaho	624,083	.092	.174	79	.684	18.582	175,225	.002	24.258
Montana	116,299	.183	.589	15,801	.229	6.776	37,190	.031	6.974
Nevada	651,667	.108	.312	74,792	.086	3.439	80,602	.016	3.763
New Mexico	290	.297	.914	680	.250	7.726	4,394	.002	5.258
Oregon	6,122	.287	1.476				47	.021	9.170
South Dakota	1,230,162	.378	.089				10		1.000
Texas									
Utah	4,726	.324	.954	93,035	.060	2.796	73,874	.021	5.395
Washington	69,836	.415	2.266				3,246		2.573
Wyoming	1,800	.214	.012						
Total	3,376,129	.254	.268	412,378	.069	2.926	476,960	.013	12.599
States east of the Mississippi	10	.400							
Total	3,376,139	.254	.268	412,378	.069	2.926	476,960	.013	12.599

See footnotes at end of table.

Ore produced in the United States and average recovery, in fine ounces, of gold and silver per ton in 1949[1]—Continued

State	Copper ore			Lead ore			Lead-copper ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States and Alaska:									
Alaska				2,100	0.164	1.780			
Arizona	37,365,611	0.002	0.065	15,829	.108	4.853	45		6.022
California	250	.128	4.396	37,553	.100	8.147	106	0.019	5.443
Colorado	3,838	.077	15.391	42,750	.044	5.186	27	.037	16.444
Idaho	384	.026	1.443	287,664	.003	5.128	33	.061	81.879
Montana	1,231,266	.004	1.499	21,248	.062	4.379	3		57.000
Nevada	4,897,598	.008	.027	19,995	.048	12.620	103	.019	12.291
New Mexico	6,105,174		.025	7,152	.008	1.025			
Oregon	46	.043	.478						
South Dakota									
Texas	1,249		.065	891	.045	2.929			
Utah	20,924,274	.013	.107	20,304	.045	5.621			
Washington	106	.123	10.434	14,422		2.498			
Wyoming									
Total	70,529,796	.006	.097	469,908	.025	5.509	317	.022	17.132
States east of the Mississippi	4,875,419		.014	37,800					
Total	75,405,215	.005	.092	507,708	.023	5.099	317	.022	17.132

State	Zinc ore			Zinc-lead, zinc-copper, and zinc-lead-copper ores			Total ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States and Alaska:									
Alaska							78,839	0.106	0.065
Arizona	10,344	0.012	1.071	942,083	0.026	2.274	38,372,879	.003	.130
California	21,078	.030	3.962	56,992	.003	4.711	494,906	.337	1.548
Colorado	182,665	.015	.807	526,201	.061	2.444	1,262,355	.071	2.291
Idaho	[2] 49,401		.303	1,920,206	.002	2.183	[2] 3,057,075	.021	3.286
Montana	[3] 34,100	.003	1.624	1,140,027	.009	3.418	[3] 2,595,934	.017	2.437
Nevada	72,315	.007	[4].710	189,941	.026	3.138	5,987,013	.020	.300
New Mexico	363,322	.002	.386	58,590	.001	.843	6,539,602		.058
Oregon							6,215	.283	1.527
South Dakota				(5)			1,230,172	.378	.089
Texas							2,140	.019	1.257
Utah	[6] 33,705	.003	.358	843,549	.043	4.388	[6] 21,993,467	.014	.306
Washington	54,605		.044	859,983	.049	.174	1,012,198	.071	.354
Wyoming							1,800	.214	.012
Total	821,535	.006	.631	6,547,572	.024	2.487	82,634,595	.018	.416
States east of the Mississippi	1,790,701		.001	1,384,337		.015	[7] 8,088,267	(7)	[7].011
Total	2,612,236	.002	.199	7,931,909	.020	2.055	90,722,862	.016	.380

[1] Missouri excluded.
[2] Includes 22,389 tons of old lead-smelter slag.
[3] Includes 14,585 tons of old zinc slag fumed.
[4] Includes metal recovered from tungsten ore.
[5] 16 tons lead concentrates derived from zinc-lead ore milled and recorded in 1948, but shipped in 1949.
[6] Includes 17,480 tons of zinc slag.
[7] Excludes magnetite-pyrite-chalcopyrite ore and gold and silver therefrom.

Gold, gold-silver, and silver ores containing too little copper, lead, or zinc to be classified as copper, lead, zinc, or mixed base-metal ores are called "dry" ores, regardless of the ratio of concentration, except low-grade ore milled chiefly for its copper content and having very little or no precious-metal content (chiefly the "porphyry coppers") and ores from which separate products of lead concentrates and zinc concentrates are made. The crude ore into the mill in these two exceptional instances thus takes its name from its products—a name that is also justified by the mineralogical content and final recovery of metals. The "dry ores" thus are ores, chiefly siliceous, valuable for their gold and silver content and, in some instances, for their fluxing properties, regardless of method of treatment. Dry gold ores are those that by inspection are overwhelmingly of gold content; a similar qualification applies to silver ores; decision as to "gold-silver" ore is made on a basis of value, using the rule that the bimetal classification is not used unless the metal of lower value equals or exceeds one-quarter of the combined value of the gold and silver.

The lead, zinc, and zinc-lead ores in most districts in the States east of the Rocky Mountains carry no appreciable quantity of gold or silver; such ores are excluded from this report unless otherwise indicated.

Mine production of gold in the United States, 1940–44 (average) and 1945–49, by percent from sources and in total fine ounces

Year	Percent from—						Total fine ounces
	Placers	Dry ore	Copper ore	Lead ore	Zinc ore	Zinc-lead, zinc-copper, lead-copper, and zinc-lead-copper ores	
1940–44 (average)	27.8	50.8	17.3	0.6	0.1	3.4	3,088,027
1945	19.3	29.9	37.5	.6	.7	12.0	954,572
1946	37.5	39.5	16.1	.4	.4	6.1	1,574,505
1947	32.2	38.5	23.8	.5	.4	4.6	2,109,185
1948	29.8	39.5	22.4	.5	.2	7.6	2,014,257
1949	26.8	44.8	19.8	.6	.2	7.8	1,991,783

Mine production of silver in the United States, 1940–44 (average) and 1945–49, by percent from sources and in total fine ounces

Year	Percent from—						Total fine ounces
	Placers	Dry ore	Copper ore	Lead ore	Zinc ore	Zinc-lead, zinc-copper, lead-copper, and zinc-lead-copper ores	
1940–44 (average)	0.2	34.9	30.0	6.5	0.8	27.6	53,501,924
1945	.1	24.3	31.4	4.4	2.0	37.8	29,024,197
1946	.3	24.4	24.4	7.5	2.3	41.1	22,914,604
1947	.2	25.7	23.1	8.0	2.1	40.9	35,823,563
1948	.2	26.6	20.7	5.9	1.5	45.1	38,096,031
1949	.2	23.5	20.0	7.8	1.5	47.0	34,674,952

Mine production of gold in the United States in 1949, by States and sources, in fine ounces, in terms of recoverable metals

State	Placers	Dry ore	Copper ore	Lead ore	Lead-copper ore	Zinc ore	Zinc-lead, zinc-copper, and zinc-lead-copper ores	Total
Alaska	221,089	7,983		344				229,416
Arizona	565	3,081	78,735	1,710		127	24,775	108,993
California	250,548	162,083	[1] 64	3,738	2	641	155	417,231
Colorado	13,143	52,616	296	1,860	1	2,654	32,048	102,618
Georgia	17	1						18
Idaho	15,078	57,655	10	772	2	16	4,296	77,829
Montana	9,821	26,034	5,027	1,312		99	10,431	52,724
Nevada	7,942	77,968	38,135	964	2	526	4,862	130,399
New Mexico	31	263	2,304	56		559	36	3,249
North Carolina	10	3						13
Oregon	14,465	1,759	2					16,226
Pennsylvania			[2] 1,645					1,645
South Dakota	1	464,626					23	464,650
Tennessee			171					171
Texas				40				40
Utah	12	8,648	267,891	907		88	36,512	314,058
Vermont			120					120
Washington	10	28,989	13			12	42,970	71,994
Wyoming	3	386						389
Total	532,735	892,095	394,413	11,703	7	4,722	156,108	1,991,783

[1] Includes metal recovered from tungsten ore.
[2] From magnetite-pyrite-chalcopyrite ore.

Mine production of silver in the United States in 1949, by States and sources, in fine ounces, in terms of recoverable metals

State	Placers	Dry ore	Copper ore	Lead ore	Lead-copper ore	Zinc ore	Zinc-lead, zinc-copper, and zinc-lead-copper ores	Total
Alaska	30,945	1,372		3,739				36,056
Arizona	63	328,295	2,412,359	76,822	271	11,076	2,141,850	4,970,736
California	17,797	79,146	[1 2] 28,442	305,934	577	83,509	268,475	783,880
Colorado	2,801	1,177,263	59,069	221,712	444	147,460	1,286,137	2,894,886
Georgia								
Idaho	4,381	4,360,657	554	1,475,017	2,702	14,950	4,190,996	10,049,257
Illinois							3,128	3,128
Michigan								
Missouri				[3] 123,413	(3)			123,413
Montana	989	434,924	1,845,783	93,039	171	55,393	3,896,726	6,327,025
Nevada	1,676	763,623	133,910	252,334	1,266	[1] 51,311	596,089	1,800,209
New Mexico	9	28,621	155,094	7,331		140,381	49,419	380,855
New York						1,200	17,178	18,378
Oregon	2,707	9,466	22					12,195
Pennsylvania			[4] 10,827					10,827
South Dakota		109,170					213	109,383
Tennessee			41,833					41,833
Texas			81	2,610				2,691
Utah		663,160	2,233,708	114,120		12,061	3,701,831	6,724,880
Vermont			27,446					27,446
Washington		166,593	1,106	36,027		2,411	151,716	357,853
Wyoming		21						21
Total	61,368	8,122,311	6,950,234	2,712,098	5,431	519,752	16,303,758	34,674,952

[1] Includes metal recovered from tungsten ore.
[2] Includes metal recovered from pyritic ore (residue).
[3] A little silver recovered from lead-copper ore from one mine included with that from lead ore.
[4] From magnetite-pyrite-chalcopyrite ore.

Gold and silver produced in the United States from ore and old tailings, in 1949, by States and by methods of recovery, in terms of recoverable metals [1]

State	Total ore, old tailings, etc. treated (short tons)	Ore and old tailings to mills						Crude ore to smelters		
		Short tons	Recoverable in bullion		Concentrates smelted and recoverable metal					
			Gold (fine ounces)	Silver (fine ounces)	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)
Western States and Alaska:										
Alaska	78,839	78,825	7,131	851	386	1,130	4,145	14	66	115
Arizona	[2] 35,004,878	34,482,033	40	16	1,356,558	88,257	3,904,455	522,845	20,131	1,066,202
California	494,906	465,880	154,358	63,148	23,289	7,437	413,509	29,026	4,888	289,426
Colorado	1,262,355	1,238,651	33,208	12,272	179,013	51,332	2,603,913	23,704	4,935	275,900
Idaho	[3] 3,057,075	3,011,615	1,214	808	296,901	60,704	9,870,960	[3] 45,460	833	173,108
Montana	[4] 2,595,934	2,464,870	6,808	14,030	451,600	24,613	5,763,802	[4] 131,064	11,482	548,204
Nevada	[5] 5,987,013	5,904,123	65,877	435,311	206,478	52,770	956,089	82,890	3,810	407,133
New Mexico	6,539,602	6,442,316	9	7	284,402	1,621	242,479	97,286	1,588	138,360
Oregon	6,215	5,428	275	97	310	822	6,010	787	664	3,381
South Dakota	1,230,172	1,230,172	464,626	109,170	16	23	213	------	------	------
Texas	2,140	------	------	------	------	------	------	2,140	40	2,691
Utah	[6] 21,993,467	21,811,661	------	------	827,219	305,047	5,894,423	[6] 181,806	8,999	830,457
Washington	1,012,198	994,458	7,920	39,589	52,887	56,955	292,438	17,740	7,109	25,826
Wyoming	1,800	1,800	86	3	35	300	18	------	------	------
Total	79,266,594	78,131,832	741,552	675,302	3,679,094	651,011	29,952,454	1,134,762	64,545	3,760,803
States east of the Mississippi	[7] 8,088,267	[7] 8,088,267	4	------	599,750	1,936	101,612	------	------	------
Total	87,354,861	86,220,099	741,556	675,302	4,278,844	652,947	30,054,066	1,134,762	64,545	3,760,803

[1] Missouri excluded.
[2] Excludes 3,368,001 tons of ore leached from which no gold or silver was recovered.
[3] Includes 22,389 tons of old lead-smelter slag.
[4] Includes 14,585 tons of old lead-smelter slag fumed.
[5] Excludes tungsten ore.
[6] Includes 17,480 tons of old slag fumed.
[7] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Gold and silver produced at amalgamation and cyanidation mills in the United States and percentage of gold and silver recoverable from all sources, 1940–44 (average) and 1945–49 [1]

Year	Bullion and precipitates recoverable (fine ounces)				Percent of gold and silver from all sources [1]							
	Amalgamation		Cyanidation		Amalgamation		Cyanidation		Smelting [2]		Placers	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1940–44 (average)	548,326	133,030	593,444	2,785,778	17.8	0.3	19.2	5.2	35.2	94.3	27.8	0.2
1945	85,450	17,024	89,350	77,088	9.0	(3)	9.4	.3	62.3	99.6	19.3	.1
1946	278,293	54,255	229,040	223,926	17.7	.3	14.5	1.0	30.3	98.4	37.5	.3
1947	378,578	80,756	272,039	273,646	17.9	.2	12.9	.8	37.0	98.8	32.2	.2
1948	378,590	104,598	278,237	481,406	18.8	.3	13.8	1.8	37.6	98.2	29.8	.2
1949	450,618	119,443	290,938	555,859	22.6	.3	14.6	1.6	36.0	97.9	26.8	.2

[1] Illinois, Michigan, and Missouri excluded 1940–46; Missouri excluded, 1947–49.
[2] Both crude ores and concentrates.
[3] Less than 0.1 percent.

Gold and silver produced at amalgamation and cyanidation mills in the United States in 1949, by States

State	Amalgamation		Cyanidation		Percent of gold and silver from all sources in State			
	Bullion recoverable (fine ounces)		Bullion and precipitates recoverable (fine ounces)		Amalgamation		Cyanidation	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Western States and Alaska:								
Alaska	7,131	851			3.11	2.36		
Arizona	40	16			.04	(1)		
California	98,630	19,594	55,728	43,554	23.64	2.50	13.36	5.56
Colorado	23,310	10,265	9,898	2,007	22.72	.35	9.65	.07
Idaho	1,214	808			1.56	.01		
Montana	4,284	2,581	2,524	11,449	8.13	.04	4.79	.18
Nevada	2,960	1,686	62,917	433,625	2.27	.09	48.25	24.09
New Mexico	9	7			.28	(1)		
Oregon	266	94	9	3	1.64	.77	.06	.02
South Dakota	312,676	83,538	151,950	25,632	67.29	76.37	32.70	23.43
Washington	8		7,912	39,589	.01		10.99	11.06
Wyoming	[2] 86	[2] 3	(2)	(2)	[2] 22.11	[2] 14.29	(2)	(2)
Total	450,614	119,443	290,938	555,859	22.65	.34	14.61	1.60
States east of the Mississippi	4				.20			
Grand total	450,618	119,443	290,938	555,859	22.62	.34	14.61	1.60

[1] Less than 0.01 percent.
[2] Gold and silver produced by cyanidation included with amalgamation.

Placers

More than one-fourth of the gold produced in 1949 was derived from placer mines. Of the 532,735 ounces of placer gold, 424,577 ounces or 80 percent was recovered by bucket-line dredges. Although this dredge output was over fourfold that of 1944, the wartime low, it was far below the all-time high of 904,149 ounces established in 1940. A number of dredge properties remained idle during 1949 because of the unfavorable economic situation for gold production.

As gold dredges are not converted readily to other uses, many idle properties had much of their operating equipment intact. It appeared probable, therefore, that gold output from this type of mining would be expanded if the ratio of gold price to dredging cost improved appreciably.

The quantity of gold recovered by bucket-line dredges from the inception of the industry as a commercial factor in 1896 to the end of 1949 is recorded as 21,326,062 ounces, originating by States as follows: California, 12,787,011 ounces; Alaska, 5,900,803 (including the production from single-dipper dredges and some gold by hydraulicking); Montana, 782,473; Idaho, 670,627; and other States, 1,185,148.

The second most important source of placer gold was the nonfloating-washing-plant method, with mechanical earth-moving equipment for gravel delivery. This was the only one of the more productive methods to show increased output in 1949 compared with 1948, a repetition of the condition that existed in 1948. Production by this method has shown an uninterrupted rise since 1944. Dragline dredging, a method that had risen phenomenally from 1933 until World War II, remained in third place in 1949. Of the other methods, hydraulicking was the most productive, although sharp decreases in 1949 and 1948 reduced output to less than twice that recorded for small-scale hand methods.

California produced 47 percent of the United States placer gold in 1949 and Alaska, 42 percent. Other large producers, named in order of importance, were Idaho, Oregon, Colorado, Montana, and Nevada. In 1949 California was the leader in all but three methods of placer-gold production. Alaska led in hydraulic and nonfloating-washing-plant production and Nevada in dry placering.

The accompanying table shows the placer gold produced in the United States, classified by mining methods, in 1945–49.

Additional information on placer mining may be found in the State reviews in this volume.

Gold production at placer mines in the United States, by classes of mines and methods of recovery, 1945–49

Class and method	Mines producing	Washing plants (dredges)	Material treated (cubic yards)	Gold recoverable		
				Fine ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucket-line dredges:						
1945	35	48	41,183,846	153,991	$5,389,685	$0.131
1946	59	75	108,197,919	470,693	16,474,255	.152
1947	60	79	120,362,326	514,931	18,022,585	.150
1948	56	77	119,927,532	473,366	16,567,810	.138
1949	51	73	110,822,581	424,577	14,860,195	.134
Drag-line dredges:						
1945	9	9	457,100	2,646	92,610	.203
1946	65	64	7,566,360	38,351	1,342,285	.179
1947	71	65	10,325,994	55,448	1,940,680	.188
1948	42	41	5,224,260	31,446	1,100,610	.211
1949	35	31	4,583,055	22,789	797,615	.174
Becker-Hopkins dredges:						
1945						
1946	1	1	5,000	32	1,120	.224
1947–49						

Gold production at placer mines in the United States, by classes of mines and methods of recovery, 1945–49—Continued

Class and method	Mines producing	Washing plants (dredges)	Material treated (cubic yards)	Gold recoverable: Fine ounces	Gold recoverable: Value	Gold recoverable: Average value per cubic yard
Surface placers—Continued.						
Gravel mechanically handled—Con.						
Suction dredges:						
1945						
1946	3	3	37,900	267	$9,345	$0.247
1947	12	10	79,590	588	20,580	.259
1948	8	9	84,200	473	16,555	.197
1949	12	13	278,765	1,418	49,630	.178
Nonfloating washing plants:						
1945	38	38	1,174,800	9,762	341,670	.291
1946	93	93	3,479,600	42,796	1,497,860	.430
1947	137	136	4,281,440	57,356	2,007,460	.469
1948	154	153	6,120,070	67,718	2,370,130	.387
1949	183	183	5,070,465	72,260	2,529,100	.499
Gravel hydraulically handled:						
Hydraulic:						
1945	111		1,200,320	14,161	495,635	.413
1946	157		2,724,350	32,278	1,129,730	.415
1947	167		2,838,440	38,722	1,355,270	.477
1948	137		1,708,650	16,976	594,160	.348
1949	81		779,800	7,107	248,745	.319
Small-scale hand methods:						
Wet:						
1945	173		126,590	3,174	111,090	.878
1946	268		681,630	5,567	194,845	.286
1947	284		783,852	11,122	389,270	.497
1948	275		296,776	9,800	343,000	1.156
1949	279		248,076	4,234	148,190	.597
Dry:						
1945	1		100	2	70	.700
1946	17		7,400	262	9,170	1.239
1947	19		2,800	161	5,635	2.013
1948	10		3,900	170	5,950	1.526
1949	13		2,870	144	5,040	1.756
Underground placers:						
Drift:						
1945	15		5,513	927	32,445	5.885
1946	26		12,407	358	12,530	1.010
1947	28		7,248	517	18,095	2.497
1948	42		20,105	551	19,285	.959
1949	26		3,717	206	7,210	1.940
Grand total placers:						
1945	382		44,148,269	184,663	6,463,205	.146
1946	689		122,652,566	590,604	20,671,140	.169
1947	778		138,681,690	678,845	23,759,575	.171
1948	724		133,385,493	600,500	21,017,500	.158
1949	[1] 680		121,789,329	532,735	18,645,725	.153

[1] A mine using more than one method of recovery is counted but once in arriving at total for all methods.

REFINERY PRODUCTION

The accompanying table contains official estimates of production of gold and silver in the United States, made by the Bureau of the Mint, based upon arrivals at United States mints and assay offices and at privately owned refineries. The mints and assay offices determine the State source of all newly mined unrefined material at the time deposits are received. The State source of material received by privately owned refineries is determined from information submitted

by them and by intervening smelters, mills, etc., involved in the reduction processes.

Gold and silver refined in the United States, 1945–49, and approximate distribution of source, by States, in 1949, in fine ounces

[U. S. Bureau of the Mint]

State or Territory	Gold	Silver
1945 [1]	928, 893	29, 063, 255
1946	1, 462, 354	21, 103, 269
1947	2, 165, 318	38, 587, 069
1948	2, 025, 480	39, 228, 468
1949:		
Alaska	226, 666	42, 451
Arizona	109, 476	4, 977, 719
California	405, 256	792, 922
Colorado	101, 685	2, 852, 449
Georgia	6	1, 707
Idaho	67, 411	9, 921, 891
Illinois		2, 176
Michigan		2, 000
Missouri		58, 255
Montana	47, 390	6, 706, 780
Nevada	124, 697	1, 878, 498
New Mexico	8, 004	516, 300
New York		5, 376
North Carolina	13	1
Oregon	14, 862	14, 154
Pennsylvania	1, 721	11, 331
South Dakota	454, 534	105, 479
Tennessee	176	43, 291
Texas	65	5, 126
Utah	300, 022	6, 574, 299
Vermont	120	27, 441
Virginia		53
Washington	59, 598	404, 823
Wyoming	247	32
Total	1, 921, 949	34, 944, 554

[1] Includes Philippine Islands production.

Gold and silver produced in the United States, 1792–1949 [1]

Period	Gold		Silver	
	Fine ounces	Value [2]	Fine ounces	Value [3]
1792–1847	1, 187, 170	$24, 537, 000	309, 500	$404, 500
1848–73	60, 021, 278	1, 240, 750, 000	146, 218, 600	193, 631, 500
1874–1949	220, 879, 289	5, 328, 314, 890	3, 878, 349, 934	2, 915, 585, 771
Total	282, 087, 737	6, 593, 601, 890	4, 024, 878, 034	3, 109, 621, 771

[1] From Report of the Director of the Mint. The estimates for 1792–1873 are by R. W. Raymond, Commissioner of Mining Statistics, Treasury Department, and since then, by the Director of the Mint.
[2] Gold valued in 1934 and thereafter at $35 per fine ounce; prior thereto, at $20.67+ per fine ounce.
[3] Silver valued in 1934 and thereafter at Government's average buying price for domestic product.

CONSUMPTION AND USES IN INDUSTRY AND THE ARTS

Monetary use has claimed by far the largest part of the gold and silver output through the years, but this use to a large extent takes the form of stockpiling in Government and private hoards that can be made available to industry and the arts without smelter or refinery preparation. In contrast, the gold and silver that enter industry and the arts are consumed much as are other metals, any return as second-

ary metal requiring the usual channels of collection, smelting, and refining. The consumption of gold and silver in the arts antedates written history, but industrial use of these two metals is a comparatively recent development.

Gold.—The arts require a much larger quantity of gold than does industry, but its corrosion-resistant and other properties have resulted in some industrial demand. Consumption in the arts increased rapidly during the war. A high marriage rate and widespread prosperity have increased the sale of jewelry, watches, and many luxury items made from gold. Comparison of 1949 gold figures with those for 1948 shows an 11-percent decrease in the return from industrial use contrasted with increases of 65 percent in issue for industrial use and 142 percent in net consumption. The issue for industrial use in 1949 was far below the level prevailing in 1946 but considerably above other recent years, whereas net use, although also far below 1946, virtually coincided with that in 1945. The net absorption by industry and the arts equaled over one and one-half times the total new gold produced from domestic mines during 1949 compared with less than two-thirds in 1948.

Net industrial consumption of gold and silver in the United States, 1940–44 (average) and 1945–49

[U. S. Bureau of the Mint]

Year	Gold (dollars)			Silver (fine ounces)		
	Returned from industrial use	Issued for industrial use	Net industrial consumption	Returned from industrial use	Issued for industrial use	Net industrial consumption
1940–44 (average)	24,699,094	80,947,913	56,248,819	34,649,557	125,935,540	91,285,983
1945	30,991,905	139,936,237	108,944,332	58,360,767	184,660,767	126,300,000
1946	45,999,837	199,686,837	153,687,000	36,646,860	123,646,860	87,000,000
1947	49,229,578	98,129,578	48,900,000	27,866,359	126,366,359	98,500,000
1948	45,142,764	90,128,764	44,986,000	23,897,173	129,186,173	105,289,000
1949	40,133,100	148,975,571	108,842,471	22,660,459	110,660,459	88,000,000

Silver.—The 1949 consumption of silver in industry and the arts was the smallest since 1941 except for 1946; the 1949 total slightly exceeded that for 1946. Consumption nonetheless was high in relation to prewar totals and exceeded any annual output ever achieved by domestic mines.

Widespread prosperity and a high marriage rate sustained postwar demand for sterling and plated silverware, jewelry, watch cases, church articles, pens, pencils, and other items largely in the luxury class. Consumption was large in photography, particularly for motion pictures. The industrial uses of silver had grown greatly during the war and continued to absorb much silver thereafter, although on a reduced scale in 1949.

MONETARY STOCKS

Gold holdings of the United States rose $183,000,000 (1 percent) from $24,244,000,000 on January 1, 1949, to $24,427,000,000 on January 1, 1950, according to the Federal Reserve Bulletin. Total world reserves are not positively known, inasmuch as data are not available from some countries, including Germany, Japan, Australia,

and U. S. S. R. Currency stabilization funds secretly held add to the difficulties in reaching an approximation.

Foreign gold reserves increased rapidly after the United States entered the war late in 1941, largely because United States war purchases abroad so greatly exceeded commercial exports in value. During the war period foreign reserves increased nearly $5,000,000,000, and United States reserves decreased over $2,500,000,000. Sharing prominently in the increase were Switzerland, Sweden, Turkey, Iran, Spain, Union of South Africa, and Latin American countries. In 1946, however, there was a reversal in the direction of the flow of gold, and the United States net increase in 1948 substantially exceeded world mine output; the excess in 1949 amounted to less than 20 percent of the world total.

United States Treasury silver holdings increased 26,000,000 fine ounces during 1949 to 1,978,000,000 ounces. The holdings do not include 410,553,011 ounces released under lend-lease agreements that provide for return of the silver.

PRICES

Since January 1934 the price of gold at the United States Mint has been $35 per fine troy ounce. The Treasury buying price for silver domestically mined after July 1, 1939, was fixed at $0.711+ per ounce on July 6, 1939; on July 31, 1946, the President approved an act (Public Law 579, 79th Congress) which provided that the seigniorage to be deducted for silver mined after July 1, 1946, and delivered to the Treasury be reduced from 45 percent to 30 percent. The effect was to raise the price of domestically mined silver to 90.50505+ cents an ounce; there has been no price change since.

According to the Director of the Mint, the following prices for silver prevailed in London and New York (exchange-free—New York on London, January 1948–August 1949, $4.03; September 1949, $3.44; October–December 1949, $2.80) in 1948 and 1949: London price, per ounce, 0.999 fine, opened in 1948 at 45d., a level maintained past midyear when after a short upward movement the price fell to 42.5d. by the year end. Changes in 1949 were of little significance until devaluation of the pound in September following which the price rose to 64d. where it remained the rest of the year. New York price, per ounce, 0.999 fine, opened in 1948 at $0.74625, a level held until August. After a small rise in the next 3 months the price declined to an average of $0.70000 in December. In early 1949 the price rose to $0.71500, where it held until September, then it rose to $0.73250 and continued at that level for the remainder of the year.

FOREIGN TRADE [1]

The excess of gold imports over exports dropped from nearly 1¾ billion dollars in 1948 to 41 percent of that amount in 1949. The gains from imports plus the output from domestic mines greatly exceeded consumption in the arts and industries, and thus gold monetary stocks increased. Consumption of silver, however, exceeded the supply from mine output plus net imports, with the result that stocks were drawn upon.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Value of gold and silver imported into and exported from the United States, 1945–49

[U. S. Department of Commerce]

	Imports	Exports	Excess of imports over exports [1]
Gold:			
1945	$93,718,050	$199,967,940	−$106,249,890
1946	532,961,768	221,467,636	311,494,132
1947	2,079,588,406	213,240,800	1,866,347,606
1948	1,981,175,178	300,771,144	1,680,404,034
1949	771,390,261	84,935,678	686,454,583
Silver:			
1945	27,278,396	90,936,901	−63,658,505
1946	57,577,888	36,454,690	21,123,198
1947	68,140,343	30,648,742	37,491,601
1948	70,884,513	12,400,060	58,484,453
1949	73,535,694	23,281,043	50,254,651

[1] Excess of exports over imports indicated by minus sign.

Gold imported into the United States in 1949, by countries

[U. S. Department of Commerce]

Country	Ore and base bullion		Bullion, refined		United States coin (value)	Foreign coin (value)
	Troy ounces	Value	Troy ounces	Value		
Australia	7,675	$268,290	73	$2,552		
Belgium-Luxembourg	2,526	88,410				
Bolivia	1,696	59,037				
Brazil	374	13,088				
British Guiana	17,114	606,034				
British Western Pacific Islands	133,111	4,653,622				
Burma	1	34				
Canada	166,567	5,838,213	812	28,435		
Newfoundland-Labrador	5,727	199,705				
Chile	66,649	2,323,768				
China						$50
Colombia	692	24,138	403,590	14,125,657		
Costa Rica	284	9,815				
Cuba	5,692	198,959				
Czechoslovakia						442
Dominican Republic	993	34,626				
Ecuador	81,165	2,835,139				
El Salvador	20,440	714,612				
Ethiopia	1,539	53,869				
France	2,329	81,542				
French Morocco	2	67				
Germany	59	2,025				
Guatemala	5	167				
Honduras	16,458	575,978	18	656		
Israel	1,240	43,408				
Italy	34	1,167				
Jamaica	7	250				
Korea	4,269	149,425				
Liberia	8,583	300,105				
Malta, Gozo, and Cyprus	2,350	82,045				
Mexico	119,935	4,167,733	922	32,270		
Netherlands Antilles					$1,000	
Nicaragua	197,569	6,905,782				
Northern Rhodesia	4,770	166,423				
Panama	109	4,045				
Peru	9,936	345,595				
Philippines	75,495	2,633,023				
Portugal	10,010	350,253	68,719	2,405,162		
Saudi Arabia	50,451	1,761,754				
Southern Rhodesia	650	21,290				
Switzerland	225	7,855				
Thailand	1	34				
Turkey	1,815	63,519				
Union of South Africa	281	9,758	5,443,151	190,510,181		
United Kingdom	19	464	15,088,710	528,104,798	5,500	13,483
Venezuela	359	12,559				
Yugoslavia	16,661	582,450				
Total	1,034,967	36,160,075	21,005,995	735,209,711	6,500	13,975

Gold exported from the United States in 1949, by countries of destination

[U. S. Department of Commerce]

Country of destination	Ore and base bullion		Bullion, refined		United States coin (value)	Foreign coin (value)
	Troy ounces	Value	Troy ounces	Value		
Belgium-Luxembourg			160	$6,000		
Brazil			724	25,339		
Canada	2	$70	738	25,870		
Ceylon			15	591		
Chile			7,107	293,210		
China			345,255	12,083,950	$269	$273
Formosa			200,012	7,000,429		
Cuba			2,964	113,567		
Denmark			1,929	69,350		
Dominican Republic			3	131		
El Salvador			5,298	185,116		
France			2,273	79,560		
French Indochina			188,672	8,639,541		
Germany			14,197	508,582		
Greece						4,086,402
Hong Kong			2,221	99,952		
Hungary			10	347		
India			12,072	421,543		
Israel			783	27,554		
Italy			685	25,020		
Kuwait			31,220	1,301,188		
Lebanon			129,379	4,748,495		
Mexico			242,993	8,504,766		107,604
Netherlands			2,769	96,954		
Panama			288	10,497		
Philippines			59,317	2,730,349		
Poland-Danzig			521,479	18,251,805		
Portugal			40,647	1,473,084		
Portuguese Asia			150,318	6,602,003		
Saudi Arabia			32	1,701		
Syria			50,000	1,749,991		
Tangier			4,126	140,936		
Thailand			8,464	388,136		
United Kingdom	2,863	97,000	3,605	148,161		
Uruguay			2,358	91,612		
Venezuela			128,048	4,496,035		
Yugoslavia			8,647	302,695		
Total	2,865	97,070	2,168,808	80,644,060	269	4,194,279

Silver imported into the United States in 1949, by countries

[U. S. Department of Commerce]

Country	Ore and base bullion		Bullion, refined		United States coin (value)	Foreign coin (value)
	Troy ounces	Value	Troy ounces	Value		
Australia	955,672	$673,091	59,765	$43,030		
Belgium-Luxembourg	655,819	463,924	1,794,225	1,256,093		
Bolivia	5,612,985	3,922,552				
Brazil	10,809	7,566				
British Western Pacific Islands	49,059	35,460				
Canada	2,159,117	1,543,648	8,329,115	5,975,851	$1,169,379	$2,988
Newfoundland-Labrador	449,845	313,263			7,460	
Ceylon	286	200				
Chile	1,224,226	853,671	63,929	45,976		
China	461,728	332,023	148,218	104,190		18,344
Colombia	4,761	3,323				
Costa Rica	720	503				
Cuba	157,411	109,854				
Denmark			325,106	231,801		
Dominican Republic					10,300	
Ecuador	247,833	173,042				
El Salvador	275,075	193,802				
France	169,538	118,352	99,653	69,897		
French Morocco	41,388	28,966				
French West Indies	1,072	750				
Germany	442,779	308,330	2,276	1,650		

Silver imported into the United States in 1949, by countries—Continued

[U. S. Department of Commerce]

Country	Ore and base bullion		Bullion, refined		United States coin (value)	Foreign coin (value)
	Troy ounces	Value	Troy ounces	Value		
Guatemala	65,080	$45,882				
Honduras	3,451,365	2,472,344	3,200	$2,240	$95	
Hong Kong	56,646	41,010				
Iran						$1,725
Israel						3,271
Italy	159,678	109,779	80,508	57,228		
Korea	56,707	39,690				
Malta, Gozo, and Cyprus	22,918	16,042				
Mexico	7,939,747	5,577,926	44,720,476	31,976,856	103,810	3,493,589
Netherlands	44,713	31,682	18,990	13,703		
Netherlands Antilles					550	
New Zealand					1,119	
Nicaragua	191,082	142,673				
Nigeria	590	413				
Northern Rhodesia	61,811	44,947				
Panama	29	20				
Peru	2,646,849	1,847,117	5,024,591	3,596,607		498,597
Philippines	359,271	253,643				
Poland-Danzig					85	
Portugal	34,863	24,368				
Saudi Arabia	59,991	42,811				
Southern Rhodesia	1,142	753				
Switzerland	1,151,517	809,862	1,054,592	754,233		
Turkey	22,686	16,609				
Union of South Africa	346,571	249,664				
United Kingdom	1,675,787	1,196,568	1,812,029	1,341,080		1,838
Venezuela	531	346				
Yugoslavia	728,151	519,695	257,080	185,945		
Total	31,997,848	22,566,164	63,793,953	45,656,380	1,292,798	4,020,352

Silver exported from the United States in 1949, by countries of destination

[U. S. Department of Commerce]

Country of destination	Bullion, refined		United States coin (value)	Foreign coin (value)
	Troy ounces	Value		
Australia				$1,800
Brazil	84,903	$62,796		
Canada	1,173,562	844,896		396,807
Colombia	192,026	142,021		
Cuba	6,780	5,314		1,971,058
El Salvador			$100,000	
France	186,317	135,704		
Germany	20,243	14,893		
Guatemala	1,448	1,095		
Haiti			7,000	
Honduras			1,000,000	
Hong Kong	25,033	17,979		14,951,655
Italy	704,862	522,448		
Mexico			405	
Norway	32,472	22,975		
Philippines				25,906
Saudi Arabia			35,000	2,425,352
Switzerland	4,818	3,785		
United Kingdom	567,747	401,138		
Uruguay	2,499	1,914		
Venezuela	4,050	3,852		186,050
Total	3,006,741	2,180,810	1,142,405	19,958,628

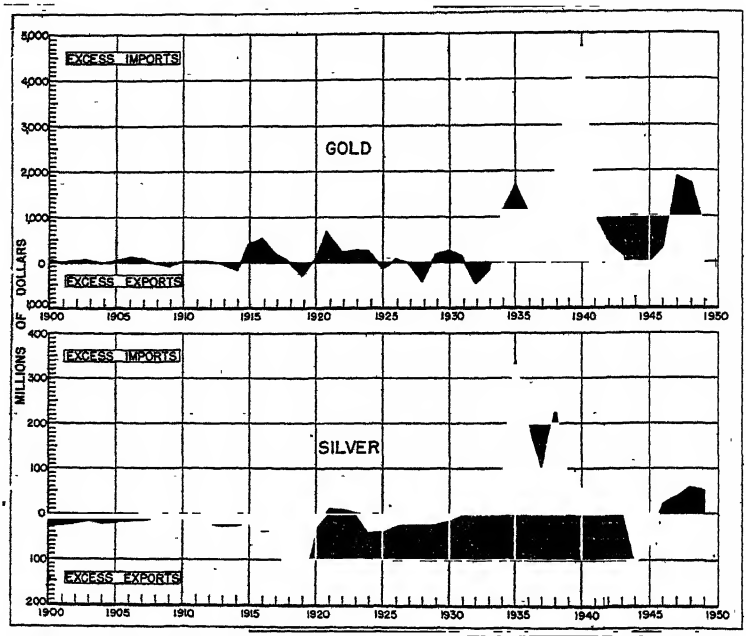

FIGURE 3.—Gold and silver imports and exports, with net movements, 1900–1949.

WORLD REVIEW

World gold output rose slightly in 1949, continuing the movement in progress since 1946, but the 1949 total continued considerably below annual quantities produced before World War II. Devaluation of the British pound and many other currencies in September 1949

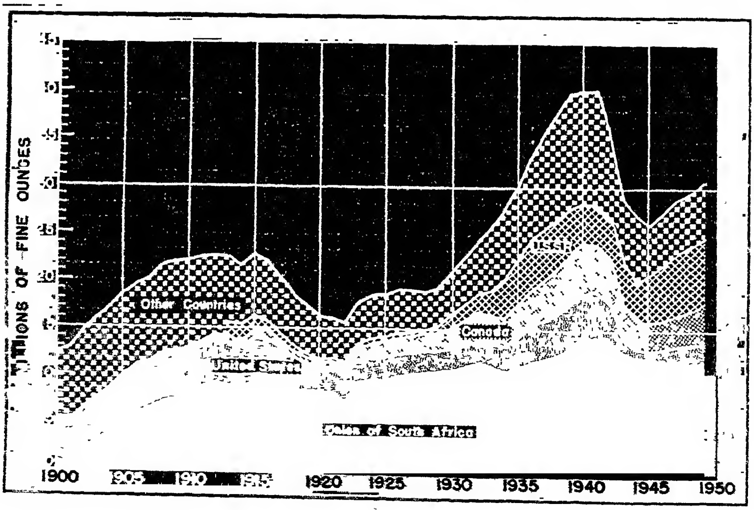

FIGURE 4.—World production of gold 1900–1949.

should result in increased production outside the United States. World silver output dropped slightly in 1949, owing largely to declines in Mexico and the United States that were not offset by gains in other silver-producing areas.

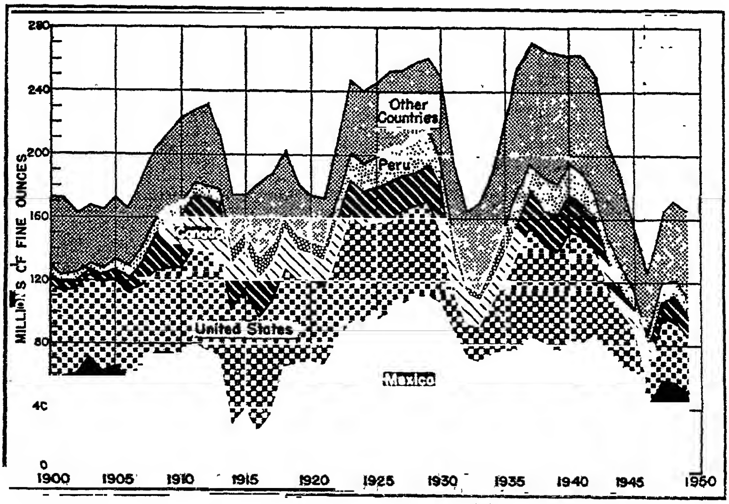

FIGURE 5.—World production of silver, 1900–1949.

World production of gold, 1944–49, by countries, in fine ounces [1]

[Compiled by Berenice B. Mitchell]

Country	1944	1945	1946	1947	1948	1949
North America:						
United States (including Alaska) [2]	1,022,238	915,403	1,462,354	2,165,318	2,025,480	1,921,949
Canada	2,922,911	2,696,727	2,832,554	3,070,221	} 3,529,608	4,103,856
Newfoundland [3]	14,715	11,767	12,854	11,032		
Central America and West Indies:						
Costa Rica [4]	3,606	3,054	1,251	1,988	1,096	284
Cuba	39	[4] 423	1,105	364	334	[4] 5,692
Dominican Republic [4]	749	486	645	16	29	993
Guatemala [4]	126	66	36	35	16	5
Haiti	161	[4] 73	41	----	----	----
Honduras	19,774	17,078	12,833	12,037	13,633	25,832
Nicaragua (exports)	222,635	206,360	203,396	213,454	222,627	219,139
Panama	----	----	----	----	1,000	[5] 9,657
Salvador (exports)	22,813	16,526	21,798	10,755	20,778	[5] 25,000
Mexico	508,882	499,301	420,500	464,739	367,612	405,550
Total	4,738,600	4,367,200	4,969,400	5,950,000	6,182,200	6,718,000
South America:						
Argentina	5,369	3,331	8,038	[5] 8,000	[5] 8,000	[5] 8,000
Bolivia	6,265	5,888	16,700	20,108	[5] 4,063	[5] 32,415
Brazil (estimate)	178,309	212,200	175,000	167,000	156,900	183,500
British Guiana	18,986	22,533	19,798	21,111	16,518	19,368
Chile	243,883	180,462	230,880	168,855	164,258	179,144
Colombia	553,539	506,695	437,176	383,027	335,260	359,474
Ecuador	85,039	68,038	75,254	57,250	79,207	99,241
French Guiana	18,583	20,641	19,741	14,918	13,625	[5] 15,000
Peru	175,180	172,661	158,378	116,016	111,162	137,963
Surinam	5,723	5,895	4,648	4,134	4,177	3,794
Uruguay	[5] 1,000	[5] 1,000	----	----	----	[illegible]
Venezuela	77,716	76,839	48,558	21,830	49,730	61,378
Total	1,370,000	1,276,000	1,194,000	982,000	943,000	[illegible]

See footnotes at end of table.

World production of gold, 1944–49, by countries, in fine ounces—Continued [1]

Country	1944	1945	1946	1947	1948	1949
Europe:						
Czechoslovakia	5,014	1,529	1,903	2,090	(7)	(7)
Finland	9,800	6,633	7,327	11,285	11,317	14,050
France	21,959	39,738	48,355	42,407	34,498	47,294
Hungary	[8] 28,215	193	1,318	1,993	(7)	(7)
Italy	6,334	1,768	8,520	11,253	18,422	(7)
Portugal			6,687	15,754	11,799	(7)
Rumania	74,590	90,987	80,377	74,686	90,000	120,000
Spain	1,961	2,025	3,729	2,714	11,375	30,318
Sweden	112,560	85,585	91,372	75,586	71,889	80,280
U. S. S. R. (estimate) [9]	4,000,000	5,000,000	6,000,000	7,000,000	7,000,000	7,000,000
Total	4,300,000	5,200,000	6,300,000	7,200,000	7,300,000	7,300,000
Asia:						
Burma	30	30	2	9	230	(7)
China				107,535	(7)	(7)
Formosa	25,978	579	424	8,387	17,668	16,607
Cyprus	958					
French Indochina [10]	13					
India	188,206	168,366	131,775	171,704	180,490	160,902
Japan	396,579	128,410	43,154	55,029	69,180	84,532
Korea:						
North	249,779	96,452	192,000	322,000	(7)	(7)
South			1,269	2,494	3,466	3,419
Malaya	1,212	287	445	5,312	10,212	13,617
Philippines		[11] 13,490	360	64,441	209,225	287,844
Sarawak	(7)	(7)	17	429	599	(7)
Saudi Arabia	[5] 8,683	[5] 37,972	48,000	52,000	74,000	67,200
U. S. S. R.	(9)	(9)	(9)	(9)	(9)	(9)
Total	872,000	446,000	418,000	790,000	665,000	684,000
Africa:						
Angola	1,296	822	552	360	443	319
Bechuanaland	11,575	11,297	9,739	7,381	1,507	256
Belgian Congo [12]	364,204	346,971	331,304	301,445	299,774	333,853
Egypt	1,036	3,014	2,793	2,090	3,853	(7)
Eritrea	169	2,119	3,411	3,674	(7)	(7)
Ethiopia	[5] 38,156	[5] 56,176	[5] 51,528	[5] 27,382	41,595	45,102
French Cameroon	20,416	16,300	11,927	11,510	10,706	8,938
French Equatorial Africa	84,106	76,069	71,535	64,044	63,715	57,273
French Guinea	(7)	(7)	4,405	7,395	88,029	(7)
French Morocco	2,572	161		1,029		(7)
French West Africa	8,777	6,945	7,009	5,564	20,512	46,381
Gold Coast	523,225	539,252	585,910	558,011	672,388	[5] 657,595
Kenya	42,259	38,517	29,892	21,959	23,429	20,072
Liberia	30,772	[5] 9,016	16,506	16,987	13,797	14,656
Madagascar	9,388	6,430	3,890	1,511	2,695	1,663
Mozambique	7,577	7,897	5,766	5,427	5,427	(7)
Nigeria	7,916	8,108	4,881	2,203	2,899	2,515
Northern Rhodesia	307	265	[13] 6,838	[13] 779	[13] 1,180	[13] 1,186
Sierra Leone	1,026	274	183	2,400	2,193	2,160
Southern Rhodesia	592,729	568,241	544,596	522,735	514,440	528,180
South-West Africa	97	83	67	34	455	32
Sudan	1,820	1,623	3,670	3,725	3,579	4,114
Swaziland	2,299	3,583	4,914	5,637	3,110	2,841
Tanganyika (exports)	55,148	49,302	48,428	47,317	57,557	68,989
Uganda (exports)	2,593	2,295	2,176	1,366	1,158	650
Union of South Africa	12,279,629	12,224,629	11,927,165	11,200,281	11,584,849	11,705,048
Total	14,089,000	13,979,000	13,679,000	12,822,000	13,423,000	13,595,000
Oceania:						
Australia:						
Commonwealth	656,867	657,212	824,480	937,654	890,805	896,872
New Guinea			661	59,202	86,556	95,100
Fiji	40,407	94,964	82,402	94,353	93,059	104,036
New Zealand	142,287	128,364	119,271	112,260	93,903	84,856
Total	839,561	880,540	1,026,814	1,203,469	1,164,323	1,180,864
World total (estimate) [1]	26,200,000	26,100,000	27,600,000	28,900,000	29,700,000	30,600,000

See footnotes on next page.

[1] Figures used derived in part from American Bureau of Metal Statistics. For some countries accurate figures are not possible to obtain owing to clandestine trade in gold. Data not available for Austria, Bulgaria, Germany, Norway, and Yugoslavia; estimate not included in total. In addition, production in Indonesia and Papua was negligible, and Thailand produced none in 1944–47.
[2] Refinery production. Excludes production of the Philippines.
[3] Data revised as recent information states the gold in zinc concentrates is not recoverable.
[4] Imports into United States.
[5] Exports.
[6] Estimate.
[7] Data not available; estimate included in total.
[8] Includes gold mined in Transylvania which temporarily formed part of Hungary.
[9] Output from U. S. S. R. in Asia included with U. S. S. R. in Europe.
[10] Lode only.
[11] Figure published by Director of the Mint, representing gold of Philippine origin refined but not necessarily mined during the year.
[12] Includes Ruanda-Urundi.
[13] Included is yield from Nkana mine refinery slimes accumulated during the war: 6,594 ounces in 1946, 547 in 1947, 999 in 1948, and 972 in 1949.

World production of silver, 1944–49, by countries, in fine ounces [1]

[Compiled by Berenice B. Mitchell]

Country	1944	1945	1946	1947	1948	1949
North America:						
United States [2]	35,651,049	29,046,047	21,103,269	38,587,069	39,228,468	34,944,554
Canada	13,627,109	12,942,906	12,544,100	12,504,018	16,109,982 (Canada and Newfoundland)	16,937,641 (Canada and Newfoundland)
Newfoundland	1,163,206	1,076,129	1,107,827	956,052		
Central America and West Indies:						
Costa Rica [3]	3,506	1,380	604	1,470	3,029	720
Cuba	[3] 42,985	[3] 107,195	127,222	146,932	185,216	[3] 157,411
Honduras	3,115,352	3,003,495	2,682,910	2,413,399	3,170,871	3,431,614
Nicaragua (exports)	248,529	240,197	260,637	213,417	212,463	206,507
Salvador	[4] 305,922	[4] 223,705	[4] 313,180	[4] 265,104	[4] 216,342	[3] 275,075
Mexico	65,460,073	61,097,727	43,263,132	58,843,863	57,519,703	49,447,842
Total	119,618,000	107,739,000	81,403,000	113,931,000	116,646,000	105,401,000
South America:						
Argentina [5]	1,695,000	2,760,000	3,090,000	2,435,400	1,201,900	1,249,421
Bolivia (exports)	6,797,631	6,683,561	6,106,165	6,233,354	7,562,208	6,634,627
Brazil	28,722	28,385	21,968	20,293	23,095	21,041
Chile	996,544	825,438	557,333	747,055	861,961	799,685
Colombia	197,323	168,699	151,971	110,352	109,188	106,590
Ecuador	441,345	235,500	192,200	156,931	226,664	279,247
Peru	15,832,440	12,997,741	12,334,150	10,782,909	9,288,777	10,627,717
Total	25,989,000	23,699,000	22,454,000	20,486,000	19,274,000	19,718,000
Europe:						
Austria	13,960	----------	----------	----------	(6)	(6)
Czechoslovakia [5]	675,000	300,000	600,000	1,400,000	1,600,000	(6)
Finland	90,344	45,236	146,929	188,821	167,615	171,150
France	240,134	350,025	535,213	474,320	494,403	395,445
Germany (Federal Republic)	(6)	(6)	(6)	(6)	[7] 867,459	1,601,782
Hungary	[8] 614,300	[8] 3,200	14,854	(6)	(6)	(6)
Italy	81,052	1,382	125,709	337,936	663,270	793,545
Norway	170,399	131,818	202,550	228,270	215,410	144,700
Portugal	----------	----------	----------	7,395	35,366	(6)
Rumania	71,310	189,689	(6)	481,264	(6)	(6)
Spain	778,016	497,661	669,009	638,192	339,396	514,090
Sweden	1,292,299	1,135,178	1,294,935	1,088,656	1,137,943	1,140,708
United Kingdom	34,660	27,517	23,285	23,522	25,000	(6)
Total (estimate)	15,000,000	12,000,000	13,000,000	15,000,000	17,000,000	19,000,000
Asia:						
Burma	----------	----------	----------	----------	[5] 450,000	----------
China	(6)	(6)	(6)	1,747	(6)	(6)
Formosa	127,873	3,156	108	1,856	7,042	4,836
Cyprus	4,882	----------	----------	----------	----------	----------
India	14,299	14,154	9,821	12,422	12,797	(6)
Japan	7,405,634	4,293,121	1,281,625	1,792,050	2,185,672	2,887,265
Korea:						
North	2,577,525 (North and South)		[5] 128,600	[5] 128,600	(6)	(6)
South		----------	27,572	38,689	38,505	18,932
Philippines	----------	17,208	3,600	54,940	150,760	218,419
Saudi Arabia	3,514	24,144	31,307	49,805	(6)	(6)
Total (estimate)	10,000,000	4,500,000	1,500,000	2,200,000	3,000,000	3,200,000

See footnotes at end of table.

World production of silver, 1944–49, by countries, in fine ounces [1]—Continued

Country	1944	1945	1946	1947	1948	1949
Africa:						
Algeria	48,612	14,661	39,996	24,435	(6)	(6)
Bechuanaland	1,319	1,237	1,704	1,086	233	23
Belgian Congo	2,732,813	4,141,016	5,047,666	4,057,295	3,805,619	4,549,330
French Morocco	65,427	107,609	117,157	356,712	(6)	(6)
Gold Coast (exports)	56,820	36,666	54,525	41,329	[5] 41,000	38,887
Kenya	11,500	16,659	5,493	3,859	3,184	2,279
Mozambique	844	998	805	712	712	(6)
Nigeria	1,079	1,106	666	2,130	4,270	484
Northern Rhodesia		2,269	[9] 634,392	[9] 73,277	[9] 145,865	[9] 134,920
Southern Rhodesia	103,776	95,975	95,168	91,900	81,404	84,495
South-West Africa				[5] 390,000	323,647	642,500
Swaziland	78	163		211	124	120
Tanganyika (exports)	17,120	21,377	21,096	20,794	25,010	27,631
Tunisia	35,205	34,369	60,122	53,852	(6)	156,638
Uganda (exports)	306	275	205	87	(6)	(6)
Union of South Africa	1,213,051	1,243,426	1,207,373	1,147,694	1,170,951	1,159,375
Total	4,288,000	5,718,000	7,287,000	6,266,000	5,800,000	7,000,000
Oceania:						
Australia:						
Commonwealth	9,365,726	8,076,740	9,045,280	9,527,140	10,057,519	9,849,213
New Guinea				[10] 35,421	[10] 31,739	(6)
Fiji	9,355	29,398	26,351	33,237	29,187	29,755
New Zealand	328,281	244,544	224,341	221,984	232,563	232,599
Total	9,703,000	8,351,000	9,296,000	9,818,000	10,351,000	10,142,000
World total (estimate) [1]	184,600,000	162,000,000	135,000,000	167,700,000	172,000,000	164,500,000

[1] Silver is also produced in Bulgaria, Greece, Hong Kong, Federation of Malaya, Indonesia, Poland, Sarawak, Sierra Leone, Turkey, U. S. S. R., and Yugoslavia; production data are not available, but estimates are included in total.
[2] Excludes the Philippines.
[3] Imports into the United States. Scrap is included in this figure in many instances, most notably in the case of Cuba.
[4] Exports.
[5] Estimate.
[6] Data not available; estimate included in total.
[7] American and British zones only.
[8] Data represent Trianon Hungary after October 1944.
[9] Recovered from an accumulation of refinery slimes.
[10] Fiscal year ended May 31 of year following that stated.

Australia.—Production of gold in Australia was virtually unchanged in 1949 as compared with 1948 and was 4 percent less than in 1947. Average monthly output in the first nine months of the year exceeded that in the final quarter, indicating that Australia failed to follow the general production pattern of the world which showed gold output on the rise after devaluation of the pound sterling in September 1949, and the increase in the price of gold in Australia from £10 15s. 3d. to £15 9s. 3d. Reports from Australia nonetheless indicated that devaluation had improved the outlook for gold production.

Canada.—Gold represents the chief value in Canadian mineral production; output of this metal places Canada at least third among world gold producers—after the Union of South Africa and doubtless also the U. S. S. R. As in the case of the Union of South Africa, devaluation of the Canadian dollar in September (which added $3.50 an ounce to the price paid for gold) helped to offset growing mining costs and benefited producers of gold. Output of gold rose 16 percent in 1949, and all territories but British Columbia (and in addition, Nova Scotia, where very small quantities are involved) shared the gain. The rise in 1949 marked continuation of the movement in progress since 1945. The Government subsidy to gold mines, scheduled to run 3 years from December 1947, was not expected to

extend beyond the end of 1950. Varying bonuses were paid to mines according to needs. At the end of 1949 the bonuses were to be reduced $3.50 an ounce; as a result, mines getting $3.50 an ounce or less would thereafter receive no bonus.

Output of gold in 1948 and 1949 was as follows, in fine ounces:

Province or Territory:	*1948*	*1949*
British Columbia	306, 998	301, 400
Manitoba and Saskatchewan	194, 103	234, 187
Northwest Territories	101, 625	178, 069
Ontario	2, 095, 377	2, 330, 108
Quebec	770, 625	972, 510
Yukon	60, 614	78, 577
Others [1]	266	9, 005
Total	3, 529, 608	4, 103, 856

[1] Alberta and Nova Scotia, and from May 1949, also Newfoundland.

Output of silver rose 5 percent in 1949, a continuation of the increase over the recent low rate in 1947. Canada ranks third also in silver production in the world, following Mexico and the United States in output of this metal.

Canada exported 6,211,912 ounces of refined silver and 4,054,614 ounces of silver in ores and concentrates, compared with 5,434,364 and 3,294,691 ounces, respectively, in 1948.

Colombia.—In production of gold Colombia leads other countries in South America by a substantial margin. According to a report [2] recently published, the value of gold produced in Colombia since the Spanish conquest has totaled nearly a billion dollars. This includes an estimated $639,000,000 worth (Spanish and Colombian currencies, approximately equivalent to United States currency) which together with $33,000,000 worth of silver was produced from 1537 to 1886. Prior to the Spanish conquest, the aborigines produced and used gold for ornaments and utensils.

The gold output fluctuated from about 300,000 ounces per year in 1915–20 to a low of 136,576 in 1929 and a peak of 656,028 in 1941. The report contains descriptions of the various gold-producing districts and mines.

Silver is recovered only as a byproduct of gold mining. In 1931–45, 2,757,473 ounces of silver were produced compared with 6,836,643 ounces of gold in the same period.

Honduras.—Honduras leads all other Central American countries in the output of silver and is exceeded by only five countries in the Western Hemisphere. According to Mineral Trade Notes,[3] the New York & Honduras Rosario Mining Co., operated the San Juancito and El Mochito mines in 1949. The former produced 2,283,068 ounces of silver and 15,393 ounces of gold, and the latter, 1,138,137 and 709 ounces, respectively. Smaller producers also contributed some gold. Exports of silver were 3,389,513 ounces in the fiscal year 1948–49 compared with 2,632,572 ounces in 1947–48, and of gold were 20,820 and 18,984 ounces, respectively.

[2] Singewald, Quentin, D., Mineral Resources of Colombia (other than petroleum): Geol. Survey Bull. 964–B, 1950, pp. 120–139.

[3] Bureau of Mines, Mineral Trade Notes: Gold and Silver—Honduras, vol. 30, No. 4, April 1950, pp. 9–10.

Japan.—Gold and silver in Japan was the subject of a recent report.[4] The report states that Japan has been a producer of gold and silver for centuries. Early gold output was largely from placer operations, but this method has decreased in importance and recently accounted for only about 1 percent of the total. As nearly as could be determined, from the incomplete source of material, the outstanding gold-silver producing mines are the Konomai, Kushikino, Teine, Oya, Taio, Sado, and Mochikoshi. The Konomai and Teine mines are in Hokkaido, the Kushikino in Kyushu, and the Mochikoshi on the Izu Peninsula on Honshu. These are the three most important gold districts in Japan. Considerable gold and silver have been produced as a byproduct of base metal mining operations. Japan's future gold and silver production, it was said, under present conditions will be confined almost entirely to that recovered as a byproduct, because other metal prices have tended to keep pace with inflation.

Mexico.—Mexico stands first in the world in output of silver, by a wide margin over the United States, which ranks second. After October 21, 1948, silver exports, whether in coins or bars, were subject to the approval of the Banco de Mexico. According to Handy and Harman,[5] it was believed that the bank was ready to accept all offers of Mexican refined production. Weakness in the dollar-peso exchange rate jeopardized the coinage program, and it was reported that only 900,000 ounces of silver were consumed by Mexico for internal coinage in 1949. Further minting of silver coins for domestic circulation was discontinued. The same source stated that, nonetheless, coinage elsewhere supplied the Bank of Mexico with a market for the principal part of the 57,000,000 ounces of silver disposed of in 1949. Early in the year negotiations with the Saudi Arabia Government resulted in two contracts for a total of nearly 13,500,000 ounces, and subsequent contracts called for sales to China of 32,500,000 ounces. An additional 5,000,000 ounces were in the form of old 0.9027 fine pesos destined for far eastern centers, and miscellaneous sales totaling 6,000,000 ounces were made in New York.

It is reported that the Bank of Mexico inaugurated in 1949 the minting of silver disks of sterling fineness, containing 1 ounce of pure silver, stamped with weight and fineness but with no monetary or face value indicated, in the expectation that the Far East might provide a ready market for such a barter coin. The conventional coins, however, evidently were much preferred; and it is said that only 1,000,000 of the new disks were struck, of which 900,000 remained in possession of the Bank.

At the end of the year, the Mexican Congress authorized a new domestic silver coinage program, providing for the minting of 1-peso, 50-centavo and 25-centavo coins, to be composed of 300 parts of silver, 100 parts nickel, 100 parts zinc, and 500 parts copper.

Union of South Africa.—The South African gold-mining industry benefited in 1949 from devaluation of the South African pound[6] on

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[4] Grant, Robt. Y., Gold and Silver Mining Industry of Japan: Bureau of Mines, Mineral Trade Notes, Special Suppl. 28, 1948, 10 pp.

[5] Handy and Harman, 34th Annual Review of the Silver Market: 1949, 28 pp.

[6] The Mining Journal (London), South Africa: Annual Review Number, 1950, pp. 89 and 91.

September 19, virtually coincident with the devaluation of the British pound sterling, and partly as a result thereof production in this area in 1949 gained slightly as compared with 1948 and was the largest since 1946. In the early part of the year, gold was paid for by the Union Treasury at 172s. 6d. an ounce and beginning September 19 at the rate of 248s. 3d. an ounce. The increased price made it possible to treat ores containing smaller quantities of gold and the average content of 3.791 dwt. per ton in December marked a new record low figure. Other benefits were increased wages for European and native workers, greater earnings, and larger dividends. The increased pay was said to have attracted larger numbers of native laborers to the field and thus to have made possible the larger output from lower grade ores.

During the year arrangements were made for some of the gold produced to be sold for industrial and artistic purposes at a premium for the benefit of producers. This device yielded additional revenue of £1,066,949 in 1949, which is not included in the accompanying table.

Salient statistics of gold mining in the Union of South Africa, 1946–49

[Transvaal Chamber of Mines]

	1946	1947	1948	1949
Ore milled (tons)	56,927,500	53,712,300	55,285,700	56,881,550
Gold recovered (fine ounces)	11,917,914	11,197,638	11,574,871	11,708,013
Gold recovered (dwt. per ton)	4.024	3.982	4.012	3.942
Working revenue	£99,249,814	£92,740,023	£96,179,355	£110,617,476
Working revenue per ton	34s. 10d.	34s. 7d.	34s. 9d.	38s. 11d.
Working cost	£72,920,881	£71,309,136	£72,383,938	£76,667,643
Working cost per ton of ore	25s. 7d.	26s. 7d.	26s. 2d.	27s. 0d.
Working cost per ounce of metal	127s. 4d.	133s. 4d.	130s. 7d.	136s. 9d.
Working profit	£26,328,933	£21,430,887	£23,790,417	£33,949,793
Working profit per ton	9s. 3d.	8s. 0d.	8s. 7d.	11s. 11d.
Dividends	£13,406,349	£11,845,035	£13,419,443	£17,394,046

Gypsum

By Joseph C. Arundale and M. G. Downey

GENERAL SUMMARY

THE year 1949 again witnessed high production of gypsum. Shortages of most gypsum products had largely disappeared by the end of 1948, as residential building on a seasonally adjusted basis declined from the third quarter of 1948 into the second quarter of 1949. During this period, easing of demand and growth of capacity permitted rapid inventory accumulations, which brought stocks of most gypsum products into adequate relation with sales. The trend of economic activity in the first half moved downward for the first time in the past few years of reconversion from war to peace. In the second half of 1949, a substantial recovery from this mild recession occurred in the field of residential building, as easy credit and high demand for housing continued through the end of the year.

Production of crude and calcined gypsum, imports of crude gypsum, and sales by producers of most gypsum products lagged behind 1948, but they were still high, in most instances the second highest on record. Most of the lag in sales probably was attributable to inventory liquidation by dealers.

At the end of 1949, many factors pointed to increased building activity; and forecasts for 1950 were very optimistic, indicating still more favorable marketing conditions for the gypsum industry.

Salient statistics of the gypsum industry in the United States, 1945–49

	1945	1946	1947	1948	1949
Active establishments [1]	75	80	93	95	88
Crude gypsum: [2]					
Mined ... short tons	3,811,723	5,629,398	6,208,216	7,254,535	6,608,118
Imported ... do	508,762	1,457,140	2,157,049	2,859,209	2,593,329
Apparent supply ... do	4,320,485	7,086,538	8,365,265	10,113,744	9,201,447
Calcined gypsum produced: [3]					
Short tons	2,485,090	4,169,662	5,010,918	6,243,392	5,767,163
Value	$14,473.566	$29,272,960	$38,726,405	$48,144,806	$45,455,419
Gypsum products sold: [3]					
Uncalcined uses:					
Short tons	1,147,797	1,641,279	1,950,181	2,226,026	1.989,893
Value	$3,432,727	$5,105,789	$7.012,106	$7,927,266	$7,127,497
Industrial uses:					
Short tons	157,796	207,178	207,226	219,472	211,635
Value	$2,326,363	$3,160,988	$3,430,022	$3,731,489	$3,562,017
Building uses:					
Value	$54,389,504	$88,927,786	$117,973,351	$165,175,523	$148,056,853
Total value	$60,148,594	$97,194,563	$128,415,479	$176,834,278	$158,746,367
Gypsum and gypsum products—					
Imported for consumption	$548,707	$1,833,088	$2,523,936	$3,114,762	$2,851,289
Exported	$1,502,668	$1,065,248	$1,599,578	$1,317,042	$1,936,148

[1] Each mine, plant, or combination mine and plant is counted as 1 establishment.
[2] Excludes byproduct gypsum.
[3] Made from domestic, imported, and byproduct crude gypsum.

DOMESTIC PRODUCTION

Crude.—Output of crude gypsum from mines in the United States totaled 6,608,118 short tons in 1949. This was the second greatest tonnage in any one year of record and only 9 percent less than the previous record set in 1948. Of the 60 active domestic mines that produced gypsum in 1949, 36 were open-pit operations, 17 were underground, and 7 were combinations of these two types. Mining was discontinued at two small mines in California, one in Nevada, and one in South Dakota.

A brief description of the quarrying operations of National Gypsum Co. at Rotan, Tex., was published.[1]

Calcined.—Fifty-one plants produced 5,767,163 short tons of calcined gypsum in 216 pieces of calcining equipment in 1949. The production of calcined gypsum is a good barometer of the activity in the industry because it includes both imported and domestic gypsum, and the bulk of gypsum products require calcined gypsum in their manufacture. It is interesting to note that production of calcined gypsum in 1949 doubled the tonnage produced in 1939.

Mine and Calcining Plant Developments.—Producers continued to mechanize, modernize, standardize, and expand operations, and efforts were made to improve efficiency and reduce costs. National Gypsum Co., for example, set goals of a $1,500,000 reduction in operating costs in 1949 and $1,000,000 in 1950. To accomplish this, the company planned readjustment of ship-unloading facilities and techniques on the east coast, standardization of high-speed production methods, standardization of new manufacturing methods, and better employee training to increase productivity.[2]

National Gypsum Co. completed a $3,500,000 expansion program at its Clarence Center, N. Y., mine, involving complete modernization and mechanization.[3]

The Gypsum Products Co. of Cody, Wyo., was purchased by the Interstate Chemical Co. of Seattle, Wash. The transaction included the company mill, warehouse, and gypsum holdings west of Cody.[4]

The Union Plaster Co., Phoenix, Ariz., changed its name to Union Gypsum Co. and is maintaining shipments of gypsum at the rate of about 1,000 tons monthly from its open-pit operation in the Saddle Mountain district near Winkelman, Ariz.[5]

Westates Agricultural Chemical Co. announced acquisition of Northwest Gypsum Co., Colfax, Wash., and expected its gypsum deposit on the Snake River, Washington County, Idaho, to be in production near the end of 1949. The company will produce agricultural gypsum.[6]

[1] Dunn, Charles P., Quarrying Texas Gypsum: Explosives Eng., vol. 26, No. 6, November-December 1948, pp. 176-178.
[2] Rock Products, vol. 52, No. 1, January 1949, p. 117.
[3] Pit and Quarry, vol. 41, No. 8, February 1949, p. 67.
[4] Pit and Quarry, vol. 41, No. 11, May 1949, p. 76.
[5] Mining World, vol. 11, No. 7, June 1949, p. 74.
[6] Mining World, vol. 11, No. 11, October 1949, p. 66.

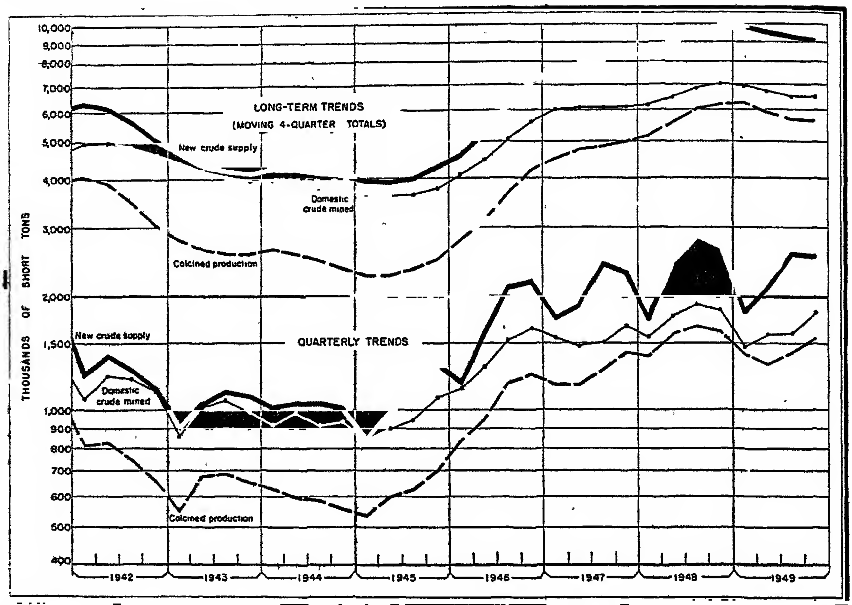

FIGURE 1.—Trends of new crude supply, domestic crude mined, and production of calcined gypsum, 1942–49, by quarters.

Crude gypsum mined in the United States, 1947–49, by States

State	1947			1948			1949		
	Active mines	Short tons	Value	Active mines	Short tons	Value	Active mines	Short tons	Value
Arizona	3	23,980	$128,725	3			3		
Arkansas	1	231,745	468,951	1	264,738	$587,134	1	234,575	$515,577
Kansas	2			2			2		
New Mexico	------	------	------	1			1		
California	12	811,798	1,996,157	15	962,038	2,354,390	13	753,581	1,852,452
Colorado	8			2			2		
Montana	2	205,979	644,583	2	217,299	717,072	2	180,794	565,836
South Dakota	1			1			------		
Wyoming	3	22,643	112,238	2			3		
Iowa	4	656,982	1,677,217	4	729,880	1,753,545	5	858,464	2,188,002
Michigan	4	1,031,157	2,760,825	4	1,309,331	3,617,868	4	1,264,511	3,470,294
Nevada	7	526,972	1,377,143	7	519,552	1,222,070	5	495,229	1,347,666
New York	7	949,375	2,613,094	7	1,228,358	3,294,973	6	916,117	2,805,154
Ohio	2	589,808	1,837,846	2			2		
Virginia	2			1	1,129,635	3,422,078	1	1,061,555	3,395,503
Oklahoma	2	326,144	912,764	2			2		
Utah	2			3			3		
Texas	6	831,633	2,000,341	5	893,704	2,143,539	5	843,292	2,178,569
Total	63	6,208,216	16,529,884	64	7,254,535	19,112,669	60	6,608,118	18,318,553

Calcined gypsum [1] produced in the United States, 1948–49, by districts

District	1948		1949	
	Short tons	Value	Short tons	Value
New Hampshire, Massachusetts, Connecticut	213, 923	$1, 838, 598	189, 189	$1, 613, 134
Eastern New York, New Jersey, Pennsylvania, Georgia, Florida	1, 215, 707	10, 814, 164	1, 147, 538	9, 856, 213
Ohio, Virginia, Indiana, Maryland	927, 191	7, 961, 381	923, 490	8, 102, 675
Western New York	696, 087	4, 647, 079	612, 044	4, 214, 174
Michigan	555, 287	4, 124, 171	529, 614	3, 926, 362
Iowa	560, 573	3, 730, 060	531, 109	3, 511, 681
Kansas, Oklahoma	313, 901	2, 386, 526	308, 507	2, 480, 122
Texas	625, 632	3, 867, 656	561, 778	3, 930, 599
Colorado, South Dakota, Montana, Utah, New Mexico [2]	241, 298	2, 002, 016	243, 205	2, 078, 000
California, Nevada, Arizona	893, 793	6, 773, 155	720, 689	5, 742, 459
Total	6, 243, 392	48, 144, 806	5, 767, 163	45, 455, 419

[1] Made from domestic, imported, and byproduct crude gypsum.
[2] No production from South Dakota in 1949.

Active calcining plants and equipment in the United States, 1947–49, by States

State	1947			1948			1949		
	Calcining plants	Equipment		Calcining plants	Equipment		Calcining plants	Equipment	
		Kettles	Other calciners [1]		Kettles	Other calciners [1]		Kettles	Other calciners [1]
California	4	10	5	4	10	5	4	10	7
Iowa	5	17	2	5	19	4	5	18	4
Michigan	4	19		4	20		4	20	1
New York	7	22	6	7	22	6	7	22	6
Texas	5	31		4	27		4	29	1
Other States [2]	28	75	24	29	77	26	27	74	24
Total	53	174	37	53	175	41	51	173	43

[1] Includes rotary and beehive kilns, grinding-calcining units, and hydrocal cylinders.
[2] Comprises calcining plants in 1947–49: 1 each in Arizona, Connecticut, Florida, Georgia, Indiana, Maryland, Massachusetts, New Hampshire, New Jersey, New Mexico (none in 1947), Oklahoma, Pennsylvania, South Dakota (none in 1949), and Wyoming (none in 1949); 2 each in Colorado, Kansas, Montana, Nevada, Ohio, Utah (3 in 1948–49), and Virginia (3 in 1947).

CONSUMPTION AND USES

New nonfarm housing unit starts during the first half of 1949 were lagging behind 1948, but increased activity during the latter half brought the total starts during 1949 to 1,025,100 compared with 931,300 starts during 1948. This enormous amount of building created a strong demand for such building materials as gypsum lath, wallboard, sheathing, and the various building plasters. Sales to distributors of most gypsum products, however, were moderately lower than in the previous year, indicating that distributors' inventories built up during the winter of 1948–49 were reduced.

Gypsum-Products Plant Developments.—Kaiser Gypsum, a division of Kaiser Industries, Inc., Oakland, Calif., acquired the Redwood City, Calif., gypsum-products plant formerly operated by the Pacific Portland Cement Co. The company plans an extensive moderniza-

tion program, including deep-water unloading facilities for bulk-ore-carrying ships serving the plant with crude gypsum from the company quarry on San Marcos Island, off the coast of Baja, California, Mexico.[7]

The new modern calcining and wallboard plant of Western Gypsum Co., which was put into production in May 1948 at Sigurd, Utah, was described.[8]

Columbia Gypsum Products, Inc., announced its plans for a $200,000 expansion of its facilities at Greenacres, Wash., in the Spokane Valley. New facilities will include a grinding and plaster plant. The company gypsum comes from a deposit at Windermere, British Columbia.[9]

U. S. Gypsum Co. announced plans for a gypsum-products plant at Gerlach, Nev., at the quarry acquired from Pacific Portland Cement Co. in 1948.[10]

An article was published describing operations at the renovated gypsum-products plant of National Gypsum at Savannah, Ga.[11]

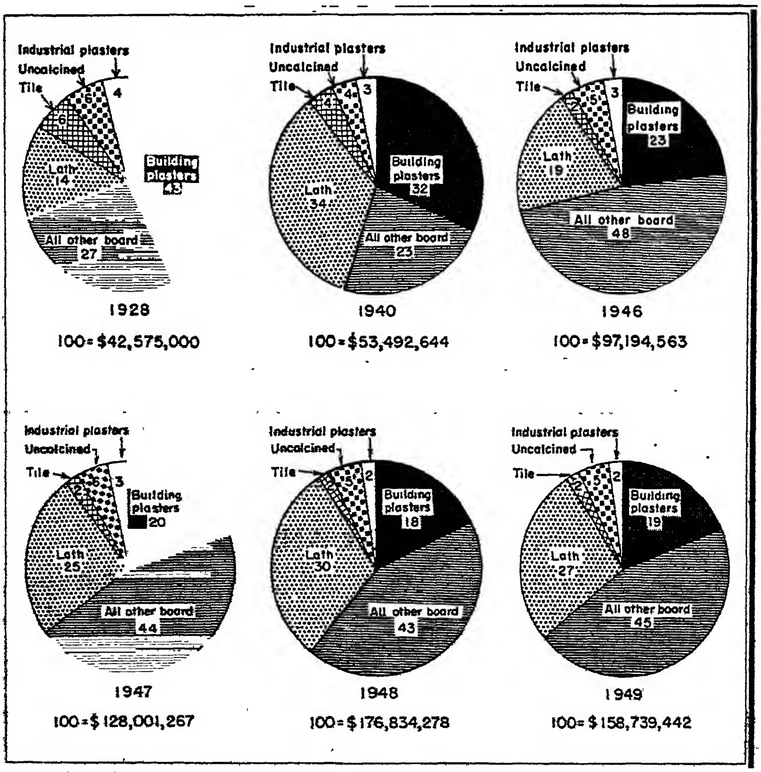

FIGURE 2.—Percentage distribution of total sales value, f. o. b. plant, of gypsum products in 1928, 1940, and 1946-49, by groups of products.

[7] Pit and Quarry, vol. 42, No. 6, December 1949, p. 51.
[8] Rock Products, vol. 52, No. 2, February 1949, pp. 91-95.
[9] Engineering & Mining Journal, vol. 150, No. 7, July 1949, p. 176.
[10] Mining World, vol. 11, No. 7, June 1949, p. 50.
[11] Rock Products, vol. 52, No. 7, July 1949, pp. 80-84.

Gypsum products (made from domestic, imported, and byproduct crude gypsum) sold or used in the United States, 1948–49, by uses

Use	1948			1949				
	Short tons	Value		Short tons	Value		Percent of change in—	
		Total	Average		Total	Average	Tonnage	Average value
Uncalcined:								
Portland-cement retarder	1,674,944	$5,538,525	$3.31	1,528,440	$4,990,796	$3.27	−9	−1
Agricultural gypsum	516,899	2,054,298	3.97	425,646	1,788,758	4.20	−18	+6
Other uses [1]	34,183	334,443	9.78	35,807	347,943	9.72	+5	−1
Total uncalcined uses	2,226,026	7,927,266		1,989,893	7,127,497		−11	
Industrial:								
Plate-glass and terra-cotta plasters	47,195	559,452	11.85	48,159	509,471	10.58	+2	−11
Pottery plasters	48,017	774,353	16.13	42,784	678,742	15.86	−11	−2
Orthopedic and dental plasters	11,432	369,035	32.28	9,738	321,757	33.04	−15	+2
Other industrial uses [2]	112,828	2,028,649	17.98	110,954	2,052,047	18.49	−2	+3
Total industrial uses	219,472	3,731,489		211,635	3,562,017		−4	
Building:								
Cementitious:								
Plasters:								
Base-coat	2,007,696	23,423,112	11.67	1,824,790	21,350,581	11.70	−9	
Sanded	131,787	1,287,190	9.77	112,375	1,170,589	10.42	−15	+7
To mixing plants	19,267	193,160	10.03	17,964	169,209	9.42	−7	−6
Gaging and molding	197,197	2,820,133	14.30	179,873	2,554,618	14.20	−9	−1
Prepared finishes	18,640	790,570	42.41	19,388	972,474	50.16	+4	+18
Other [3]	114,722	2,461,121	21.45	125,407	2,811,815	22.42	+9	+5
Keene's cement	52,066	1,008,757	19.37	44,624	919,816	20.61	−14	+6
Total cementitious	2,541,375	31,984,043		2,324,421	29,949,102		−9	
Prefabricated:								
Lath	1,873,637	53,596,957	[4] 21.40	1,519,776	43,060,474	[4] 21.36	[5] −19	
Wallboard [6]	2,102,901	72,071,432	[7] 28.40	2,036,548	68,493,078	[7] 28.03	[5] −3	−1
Sheathing board	137,885	4,431,544	[4] 34.19	102,825	3,267,935	[4] 33.68	[5] −25	−1
Tile	156,452	3,091,547	[8] 72.40	163,587	3,286,264	[8] 73.17	[5] +5	+1
Total prefabricated	4,270,875	133,191,480		3,822,736	118,107,751		[5] −10	
Total building uses		165,175,523			148,056,853			
Grand total value		176,834,278			158,746,367			

[1] Includes uncalcined gypsum sold for use as filler and rock dust, in brewer's fixe, in color manufacture, and for unspecified uses.
[2] Includes statuary, industrial casting and molding plasters, dead-burned filler, granite polishing, and miscellaneous uses.
[3] Includes insulating and roof-deck, joint filler, patching and painter's plaster, and unclassified building plasters.
[4] Average value per M square feet.
[5] Percent of change in square footage.
[6] Laminated board included with wallboard.
[7] Average value per M square feet of wallboard.
[8] Average value per M square feet of partition tile only.

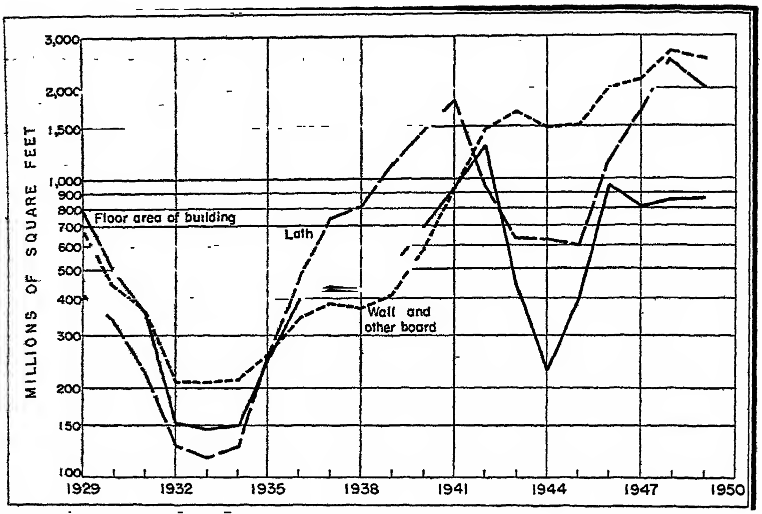

FIGURE 3.—Trends in sales of gypsum lath and wallboard and other board (includes wallboard, laminated board in terms of component board, and sheathing), compared with Dodge Corp. figures on floor area of residential and nonresidential building, 1929–49.

Gypsum board and tile sold or used in the United States, 1945–49, by types

Year	Lath			Wallboard		
	M square feet	Value		M square feet	Value	
		Total	Average [1]		Total	Average [1]
1945	599,431	$8,177,308	$13.64	1,286,912	$28,994,151	$22.53
1946	1,147,353	18,550,334	16.17	1,900,779	43,699,483	22.99
1947	1,703,818	32,241,998	18.92	2,046,216	53,122,413	25.96
1948	2,504,733	53,596,957	21.40	[2] 2,531,865	[2] 72,071,432	[3] 28.40
1949	2,015,638	43,060,474	21.36	[2] 2,439,121	[2] 68,493,078	[3] 28.03

Year	Sheathing			Laminated board			Tile [4]		
	M square feet	Value		M square feet [5]	Value		M square feet	Value	
		Total	Average [1]		Total	Average [1]		Total	Average [6]
1945	100,627	$2,304,165	$22.90	116,908	$4,002,216	$34.23	17,988	$1,824,736	$42.62
1946	76,914	2,021,691	26.29	21,317	792,560	37.18	18,865	1,814,487	47.92
1947	106,482	3,534,686	33.20	1,741	202,683	116.42	26,769	2,775,676	67.37
1948	129,632	4,431,544	34.19	(2)	(2)	(7)	27,181	3,091,547	72.40
1949	97,037	3,267,935	33.68	(2)	(2)	(7)	28,518	3,286,264	73.17

[1] Per M square feet, f. o. b.
[2] Laminated board included with wallboard.
[3] Average value per M square feet of wallboard.
[4] Includes partition roof, floor, soffit, shoe, and all other gypsum tiles and planks.
[5] Area of component board and not of finished product.
[6] Per M square feet, f. o. b. producing plant of partition tile only.
[7] Bureau of Mines not at liberty to publish figure.

PRICES

Nearly a third of the crude gypsum produced during 1949 was sold as crude for portland-cement retarder and agricultural uses. The material sold crude for portland-cement retarder had an average value of $3.27 ($3.31 in 1948), and agricultural gypsum had an average value of $4.20 ($3.97 in 1948). The average values of lath, wallboard, sheathing, and laminated board were moderately lower during the year. The average price of base-coat plaster, which is the bulk of building plaster, was virtually unchanged.

FOREIGN TRADE [12]

Imports of crude gypsum from Canada decreased slightly during the year but represented over one-fourth of total domestic supply. Small imports of crude were received from Mexico and Dominican Republic.

Gypsum and gypsum products imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Crude (including anhydrite)		Ground		Calcined		Keene's cement		Alabaster manufactures [1] (value)	Other manufactures, n. e. s. (value)	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value			
1945	508,762	$525,066	231	$4,545	67	$2,209			$499	$16,388	$548,707
1946	1,457,140	[2] 1,618,334	354	7,308	255	6,918	162	$3,686	119,937	73,573	[2] 1,829,756
1947	2,157,049	2,269,583	477	13,228	130	3,793	(3)	27	204,954	32,851	2,523,936
1948	2,859,209	2,977,809	404	13,960	11	610	12	728	83,245	38,410	3,114,762
1949	2,593,329	2,693,824	613	14,209	209	8,036			55,569	79,651	2,851,289

[1] Includes imports of jet manufactures, which are believed to be negligible.
[2] Revised figure.
[3] Less than 1 ton.

Crude gypsum (including anhydrite) imported for consumption in the United States, 1947–49,[1] by countries

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada	2,020,886	$2,109,882	2,680,681	$2,763,722	2,428,417	$2,468,124
Newfoundland—Labrador			11,733	11,733		
China	(2)	23	(2)	11	3	667
Dominican Republic	9,782	39,931	5,756	24,185	16,070	78,709
Mexico	126,374	119,344	161,039	178,158	148,839	146,324
United Kingdom	7	403				
Total	2,157,049	2,269,583	2,859,209	2,977,809	2,593,329	2,693,824

[1] Revision in Minerals Yearbook, 1948, p. 619, should read: 1946 value of crude gypsum imported from Dominican Republic $38,673; total value $1,618,334.
[2] Less than 1 ton.

[12] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Gypsum and gypsum products exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Crude, crushed, or calcined [1]		Plasterboard, wallboard and tile		Other manufactures, n. e. s. (value)	Total value
	Short tons	Value	Square feet	Value		
1945	10,028	$267,762	31,835,980	$1,017,677	$217,229	$1,502,668
1946	19,626	400,319	12,405,583	417,750	247,179	1,065,248
1947	33,208	622,034	19,417,487	645,448	332,096	1,599,578
1948	10,797	259,728	16,506,127	615,845	441,469	1,317,042
1949 [2]	17,567	423,478	53,313,138	1,336,269	176,401	1,936,148

[1] Effective Jan. 1, 1949, calcined gypsum not separable from crude, crushed, or calcined.
[2] Due to changes in items included in each classification, data are not strictly comparable with earlier years.

TECHNOLOGY

A process for making a low-water-demand, high-strength plaster of Paris was described.[13] The same procedure was independently discovered at nearly the same time in England.[14]

A process for producing a strong plaster by autoclaving ground gypsum in the presence of proteins or soluble fatty acids was patented.[15]

A booklet summarizing the history, manufacture, and development of gypsum plaster and its correct application, physical properties, fire-resistive ratings, and plastering problems and their solutions, was published by the Gypsum Association.[16]

WORLD REVIEW

Australia.—The gypsum industry of South Australia was described.[17]

Canada.—Activity in the Canadian gypsum industry was described in an article.[18] Some of the important producers in Canada are listed as Canadian Gypsum Co., Ltd., with quarries at Wentworth, Hants County, Nova Scotia; National Gypsum (Canada), Ltd., with quarry at Dingwall, Victoria County, Cape Breton Island; Victoria Gypsum Co., Ltd., at Little Narrows, Victoria County; Windsor Plaster Co., Ltd., near Windsor; Connecticut Adamant Gypsum Co., at Cheverie, Hants County; Canadian Gypsum Co., at Hillsborough, New Brunswick; Gypsum, Lime, and Alabastine, Canada, Ltd., with mine at Dingwall, Nova Scotia, and plant at Montreal East. In Ontario there are two producers of gypsum products, Gypsum, Lime & Alabastine, Canada, Ltd., at Caledonia, and Canadian Gypsum Co., Ltd., at Hagersville. In western Canada, Gypsum, Lime & Alabastine, Canada, Ltd., has plants in Winnipeg, Calgary, and New Westminster, gypsum for which is supplied by company quarries at Gypsumville, Manitoba, and Falkland, British Columbia. Western Gypsum Products, Ltd., mines gypsum at Amaranth, Manitoba, which is used in the company plants at Winnipeg and Calgary. Columbia Gypsum Products, Inc., at

[13] Eberl, James J., and Ingram, Alvin B., Process for Making High-Strength Plaster of Paris: Ind. Eng. Chemistry, vol. 41, No. 5, pp. 1061–1065.
[14] Haddon, C. L., and Cafferata, B. J., British Patent 563,019, July 26, 1944.
[15] Haddon, Cuthbert L., U. S. Patents 2,460,266 and 2,460,267, Feb. 1, 1949.
[16] Manual of Gypsum Lathing and Plastering, Gypsum Association, 37 pp.
[17] Mining Journal, vol. 232, No. 5927, Mar. 26, 1949, pp. 227–228.
[18] Bureau of Mines, Mineral Trade Notes: Vol. 28, No. 4, April 1949, pp. 30–33.

World production of gypsum, by countries,[1] 1943–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1943	1944	1945	1946	1947	1948	1949
Algeria	17,920	17,120	22,250	28,600	38,345	33,258	(2)
Anglo-Egyptian Sudan	3,641	—	2,106	3,063	350	3,045	(2)
Argentina [3]	87,461	106,313	91,504	(2)	(2)	(2)	(2)
Australia:							
New South Wales	36,862	20,540	23,137	45,136	65,098	75,304	(2)
South Australia	40,157	47,294	66,653	91,878	108,672	149,849	150,069
Victoria	9,073	8,717	11,755	15,184	23,262	29,768	31,482
Western Australia	950	3,662	7,349	15,596	20,607	25,932	26,323
Austria	(2)	(2)	(2)	26,844	14,753	(2)	(2)
Brazil	(2)	(2)	(2)	(2)	(2)	(2)	50,857
Canada	390,833	486,571	753,615	1,838,895	2,362,365	3,164,211	2,716,820
Ceylon	17	—	59	33	69	(2)	37
Chile	39,472	38,670	47,162	92,400	100,800	35,056	(2)
China	(2)	(2)	(2)	(2)	50,000	[4] 55,000	(2)
Colombia	(2)	(2)	(2)	(2)	17,372	4,200	(2)
Cuba [4]	3,200	10,000	10,400	14,300	14,900	16,500	13,880
Cyprus (exports)	134	3,492	2,608	15,464	7,844	19,500	25,788
Dominican Republic	[5] 916	[5] 2,146	[5] 3,253	[5] 10,974	13,393	7,304	(2)
Ecuador	—	—	—	—	—	410	486
Egypt	91,881	106,299	96,565	78,316	72,337	95,243	(2)
Finland	(2)	(2)	(2)	(2)	(2)	1,711	(2)
France	722,217	701,704	724,000	1,746,375	2,229,940	(2)	(2)
French Indochina	720	—	—	—	—	—	—
French Morocco	(2)	(2)	8,740	15,135	17,285	(2)	15,425
Germany	181,458	(2)	(2)	[6] 163,800	[6] 150,700	[6] 316,600	[6] 515,300
Greece	—	—	—	5,150	850	(2)	(2)
India	83,587	85,049	92,229	77,643	51,381	107,445	(2)
Ireland	21,453	21,394	23,400	37,894	36,415	(2)	(2)
Israel-Jordan	5,990	7,428	7,542	14,512	(2)	(2)	(2)
Italy	226,195	122,378	162,080	236,104	298,224	(2)	(2)
Japan	156,571	123,833	83,421	49,763	61,555	113,754	117,123
Kenya	40	254	209	508	659	1,016	181
New Caledonia	16,800	16,692	8,030	6,750	2,705	779	17,119
Pakistan	(2)	(2)	(2)	(2)	16,121	(2)	[4] 16,257
Peru	24,391	43,694	42,223	43,391	41,330	46,716	(2)
Philippines	(2)	(2)	(2)	—	—	818	2,710
Poland	(2)	(2)	(2)	9,787	14,917	14,183	(2)
Portugal	27,699	29,134	11,687	27,680	33,868	42,842	(2)
Rumania	44,044	(2)	(2)	(2)	(2)	(2)	(2)
Spain	1,105,818	1,254,830	1,038,616	[7] 1,098,013	1,337,662	[7] 1,423,728	1,293,552
Sweden	740	173	288	—	—	—	(2)
Switzerland	42,000	46,000	97,000	68,000	165,000	[4] 165,000	[4] 80,000
Syria	2,500	(2)	—	1,200	4,500	[4] 1,000	1,400
Thailand	589	133	(2)	87	71	200	154
Tunisia	3,129	7,478	8,900	8,985	17,650	19,130	22,066
Union of South Africa (sales)	47,608	57,426	66,085	66,228	80,166	78,625	88,232
United Kingdom:							
Great Britain	1,389,914	1,344,485	1,347,888	1,715,060	1,773,733	1,175,570	(2)
Northern Ireland	556	—	71	—	—	—	(2)
United States	3,517,628	3,412,116	3,457,919	5,106,877	5,631,969	6,581,169	5,994,752
Venezuela	4,775	(2)	(2)	(2)	(2)	(2)	3,042
Total (estimate)[1]	8,475,000	8,400,000	8,600,000	13,000,000	15,000,000	16,500,000	16,425,000

[1] In addition to the countries listed gypsum is produced in Angola, Belgian Congo, Ethiopia, Iraq, Jamaica, Luxembourg, Mexico, U. S. S. R., and Yugoslavia, but production data are not available. No estimates for these countries are included in the total.
[2] Data not available; estimate by senior author of chapter included in total.
[3] Rail and river shipments.
[4] Estimate.
[5] Exports.
[6] Bizonal crude production estimates based on the following calcined figures: 1946, 136,500 tons; 1947, 125,600; 1948, 263,822; 1949, 429,400.
[7] Includes Spanish Moroccan production: 1946, 1,219 tons; 1948, 1,829.

Windermere, British Columbia, began mining gypsum which is exported by rail to Spokane, Wash.

India.—The results of an intensive survey of India's reserves of gypsum were reviewed briefly in an article.[19] They reveal that preliminary surveys by the Geological Survey of India indicate conservatively 36,000,000 tons available in Bikaner and Jodhpur in the

[19] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 5, November 1949, pp. 34-35.

Rajputana region. Additional deposits are known to occur in Nagpur, Mangolad, and Kabas in Jodhpur State. Simur, Kathiawar, Cutch, and certain regions in South India are reported to have gypsum deposits. Gypsum is needed in India in the new Sindri Fertilizer plant and for the manufacture of cement. The Geological Survey of India has been instructed to carry out large-scale explorations to ascertain the quantities available.

Jamaica.—It was reported that gypsum mining had begun near Kingston by the Alcoa Steamship Co. and that most of the production will be used by the Jamaica Bellrock Co., which makes a building panel of gypsum.[20]

Union of South Africa.—The new wallboard plant of Gypsum Industries, Ltd., at Cape Town, South Africa, was described. This plant is reported to have modern calcining and wall board machinery with a rated capacity of 100 tons of calcined gypsum in 24 hours and records indicate that it will turn out 75,000 square feet of board in 24 hours.[21]

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[20] Rock Products, vol. 52, No. 9, September 1949, p. 76.
[21] Pit and Quarry, vol. 41, No. 11, May 1949, pp. 155–57.

Helium

By P. V. Mullins and R. M. Gooding

THE Bureau of Mines produces all helium used by Government agencies and commercial companies in the United States and exports small quantities, chiefly for scientific use. Helium is extracted from helium-bearing natural gases found principally in the southwestern part of the United States. All helium produced in 1949 was extracted at the Bureau of Mines Exell helium plant near Amarillo, Tex.

Helium production in 1949 was 55,165,482 cubic feet, including 5,716,700 cubic feet produced and conserved by underground storage. By comparison, 63,143,513 cubic feet were produced in 1948; 7,794,000 were conserved in underground storage. An important production development in 1949 was a substantial increase in the plant-scale production of high-purity Grade A helium—99.95 percent or higher purity—for better utilization, particularly in inert-arc welding.

The helium demand of the Navy, chiefly for lighter-than-air craft, constituted the largest single demand. Other Federal agencies used significant amounts, however, and commercial demand was a substantial proportion of the total. Helium shipments to Federal agencies in 1949 amounted to 35,133,682 cubic feet, compared with 34,877,490 cubic feet in 1948; non-Federal sales were 16,367,739 cubic feet compared with 16,037,856 cubic feet in 1948.

Reserves.—Helium-bearing natural gas for processing in Bureau plants is available from Government-owned fields and from privately owned fields through processing agreements. The principal Government-owned fields are the Cliffside and the Rattlesnake adjacent to, and available to supply gas to, the Amarillo and Navajo helium plants, respectively. The helium-bearing gas supply for the Exell plant is obtained from the West Panhandle (Tex.) field through a processing agreement with a company transporting gas from that area. The gas is being transported continuously to fuel and other markets, and the contained helium is lost if not extracted concurrently with production from the field.

The Bureau has arrangements whereby helium produced at the Exell plant, and not needed to meet demands, may be transported through a connecting pipeline to the nearby Government-owned Cliffside field and injected therein for underground storage and conservation. In 1949, 5,716,700 cubic feet of helium were produced and conserved in this manner.

Reserves of helium in the Government-owned Cliffside and Rattlesnake fields amount to an estimated 2,800,000,000 cubic feet. Helium reserves in the West Panhandle field, available to the Exell plant, are estimated at 1,500,000,000 cubic feet. Other major reserves of helium-bearing natural gas are known and may become available through purchase by the Government or execution of gas-processing agreements with the owners. No such reserves were acquired in 1949.

The Bureau conducts a continuous survey of natural gas from new field discoveries as a means of locating and obtaining information on additional reserves of helium-bearing gas. There were no important discoveries in this survey during 1949.

Production.—The following table gives helium-production statistics for Government plants in the period 1921–49, inclusive.

Helium production in the United States, 1921–49

Calendar year	Plant	Cubic feet
1921–January 1929	Fort Worth, Tex., plant	46,088,787
1929 (April)–1941	Amarillo, Tex., plant	131,887,380
1942	do	33,252,582
1943	All plants	116,307,437
1944	do	126,933,130
1945	do	94,733,744
1946	Amarillo and Exell, Tex., plants	58,236,385
1947	Exell, Tex., plant	70,297,700
1948	do	63,143,513
1949	do	55,165,482
Total 1921–49		[1] 796,046,140

[1] Includes 83,363,800 cubic feet extracted at the Exell plant from gas from the Channing area and injected into the Cliffside gas reservoir for conservation in calendar years 1945–49.

During 1949, additional plant equipment was installed to provide for continuous large-scale production of high-purity Grade A helium. About 50 percent of the helium produced in 1949 was Grade A purity—99.95 percent or higher—while the balance was about 99.8 percent pure.

During 1930–48, helium produced in Bureau plants was about 98.3 percent pure. Higher purity is obtained by passage of helium through activated charcoal at low temperature.

The Bureau's other helium plants—at Otis, Kans., and at Shiprock, N. Mex. (the Navajo plant)—were continued in standby status.

No information was acquired indicating production of helium in foreign countries in 1949, although small quantities for scientific use may have been produced by extraction from air.

Shipments and Uses.—Demand for helium in 1949 by Federal and non-Federal customers remained near the same high postwar level—about five times that prevailing in prewar years. Legislation and regulations governing helium production and sale, together with limited above-ground storage, normally cause production, shipment, and sales to be nearly identical. These conditions prevailed in 1949 when helium production amounted to 55,165,482 cubic feet, shipments to 51,501,421 cubic feet, and sales to 50,878,573 cubic feet.

In addition to the large demand of the Navy for lighter-than-air craft, the Weather Bureau continued to use helium exclusively in aerological balloons, the Atomic Energy Commission used helium in experimental work, the Army used helium as a fuel propellant in rocket experiments, and other Federal agencies used appreciable quantities for a variety of purposes. The largest and fastest-growing use of helium sold to commercial customers—and an important use among several Government agencies—was application of helium as the shielding "atmosphere" for inert-arc welding of certain metals, notably aluminum, magnesium, and stainless steel.

The following table indicates yearly shipments to Federal and non-Federal consumers of helium for 1941–49, inclusive.

Shipments of helium in the United States, 1941–49 (calendar years), in cubic feet

Calendar year	Shipments to Federal agencies				Sales for non-Federal use			Grand total, shipments
	Navy	Weather Bureau	Army and other Federal agencies	Total	Scientific and commercial	Medical	Total	
1941	11, 187, 440	4, 408, 505	5, 313, 610	20, 909, 555	789. 396	442, 604	1, 232, 000	22, 141, 555
1942	25, 402, 000	5, 090, 715	4, 787, 550	35, 280, 265	359, 085	416, 392	775, 477	36, 055, 742
1943	107, 243, 085	5, 633, 950	2, 434, 695	115, 311, 730	806, 646	513, 282	1, 319, 928	116, 631, 658
1944	111, 075, 569	7, 035, 515	2, 443, 150	120, 554, 234	2, 445, 405	562, 990	3, 008, 395	123, 562, 629
1945	38, 091, 234	8, 010, 210	11, 759, 285	57, 860. 729	2, 362, 028	565, 477	2, 927, 505	60, 788, 234
1946	15, 735, 690	9, 705, 790	9, 287, 750	34, 729, 230	7, 960, 473	1, 233, 817	9, 194, 290	43, 923, 520
1947	26, 511, 005	6, 347, 670	4, 492, 500	37, 351, 175	12, 914, 075	2, 057, 100	14, 971, 175	52, 322, 350
1948	21, 531, 788	6, 478, 931	6, 866, 771	34, 877, 490	13, 735, 645	2, 302, 211	16, 037, 856	50, 915, 346
1949	20, 398, 337	6, 396, 656	8, 338, 689	35, 133, 682	14, 039, 360	2, 328, 379	16, 367, 739	51, 501, 421

Virtually all shipments of helium made from the Exell plant were in tank cars. The remaining helium produced at the Exell plant was transported by pipeline to the Amarillo plant for reshipment by pipeline to the Cliffside field for conservation by injection into the gas reservoir. The Amarillo plant made some helium deliveries by tank car and made all shipments of helium sold in standard compressed gas cylinders. Sixty-eight percent of the helium shipped was in tank cars and 32 percent in cylinders, the latter involving shipment of 68,704 cylinders. All shipping containers for Grade A helium were cleaned internally for specific use in that service. Also, special procedures were developed and used effectively in producing and charging Grade A helium into shipping containers to avoid contamination from oil, water, air, and other foreign substances that might impair utilization of helium for inert-arc welding.

Prices.—An act of Congress approved March 3, 1925, placed responsibility on the Bureau of Mines for conservation, production, and exploitation of helium for national defense. An act of Congress approved September 1, 1937, provided, among other things, that helium not needed by the Government could be produced and sold for commercial use under regulations approved by the President. This act and related regulations provide for commercial sale of helium at a cost that reimburses the Government for the expenses of its production, handling, and sale for that purpose. Prices to non-Federal purchasers of helium in 1949 were the same as in the preceding year. The price per 1,000 cubic feet in 1949 for commercial and scientific use, when shipped from the plant in standard compressed-gas cylinders, was $15 for delivery at the helium plant. Revised regulations governing the commercial sale of helium were approved December 3, 1949, and became effective February 27, 1950. The new price per 1,000 cubic feet of helium is $13.50. When helium is delivered in standard compressed-gas cylinders, a filling service charge of $2 per 1,000 cubic feet is added for this service. No filling service charge is made for helium shipped in tank cars or semitrailers.

Technology.—Under a direct appropriation for the purpose, the Bureau conducts a modest but comprehensive research program at the Amarillo helium plant on all phases of production, shipment, and utilization of helium. During 1949, a substantial part of this research was devoted to work on: (1) Improvements in the use of helium for inert-arc welding, (2) improvement of plant equipment and processing to produce high-purity helium for inert-arc welding, and (3) development of satisfactory means for analyzing high-purity Grade A helium to provide necessary plant control and purity determinations of the final product.

Iron Ore

By Norwood B. Melcher and Jachin M. Forbes

GENERAL SUMMARY

STRATEGIC and economic aspects of the Nation's iron-ore supply continued to receive the attention in 1949 that their importance justified. Results of several years' foreign exploration for new sources of iron ore by industry were made public, and the industry's future course was taking shape. Exploration and development work on iron deposits in the Quebec-Labrador area, Venezuela, and Liberia were progressing, with the positive assurance that these new sources would be put into commercial production as soon as possible. The strategic and economic advantages to be obtained by the construction of the St. Lawrence seaway gained recognition, with iron ore playing a principal role, and it was apparent at the year end that this highly important contribution to the Nation's security and economic health was nearing realization.

Salient Statistics.—Two important factors influenced operation of iron mines in the United States during 1949. The first factor, chronologically, was diminution of demand resulting from the general business recession, which began early in the spring but was not felt at the mines until midsummer. However, it is difficult to evaluate the effects of the recession on iron-ore production because anticipation of the steel strike, the second factor, may have sustained the demand for ore during the summer months. The strike, itself, canceled

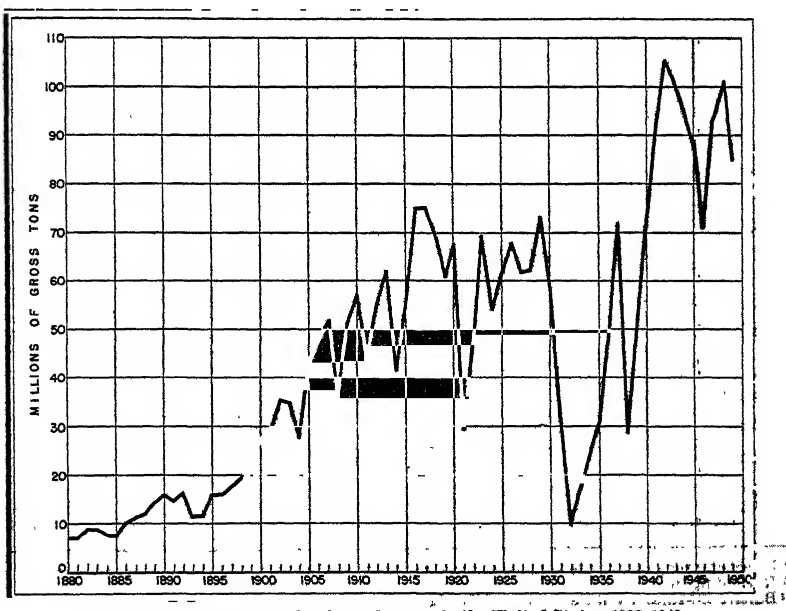

FIGURE 1.—Trends in production of iron ore in the United States, 1880–1949.

approximately 6 weeks' production and shipments during the latter part of the Great Lakes shipping season.

Domestic crude-ore production totaled 104,850,736 gross tons in 1949 compared with 126,225,172 tons in 1948, a decrease of 17 percent. Production of usable ore was off 16 percent to 84,937,447 tons, lowest since 1946, but higher than any prewar year. Usable ore includes direct-shipping ore (mine product requiring no treatment), washed ore, concentrates, sinter, and byproduct pyrites cinder and sinter.

Imports of iron ore increased again in 1949. The 21-percent increase over 1948, a total of 7,402,157 tons, established a new record and raised the proportion of imported ore to 8 percent of the supply, compared with 6 percent in 1948. Leading sources were Chile, Sweden, and Canada, supplying 35, 28, and 22 percent, respectively. Canada increased shipments to this country in 1949 by 63 percent and Sweden by 51 percent. Canada expects to up production from its Steep Rock district in 1950, but the Labrador-Quebec ores are not expected to be in commercial production for several years. Swedish imports are related to current United States economic conditions and may increase or decrease.

Salient statistics of iron ore in the United States, 1946–49

	1946	1947	1948	1949
Iron ore (usable;[1] less than 5 percent Mn):				
Production by districts:				
Lake Superior......gross tons..	59, 042, 154	76, 531, 769	82, 630, 430	68, 494, 123
Southeastern......do....	6, 247, 096	7, 527, 321	8, 365, 390	7, 601, 822
Northeastern......do....	2, 596, 349	3, 987, 195	4, 422, 971	3, 863, 833
Western......do....	2, 450, 611	4, 502, 512	5, 104, 703	4, 441, 671
Undistributed (byproduct ore)..do....	506, 903	542, 723	479, 998	535, 998
Total......do....	70, 843, 113	93, 091, 520	101, 003, 492	84, 937, 447
Production by types of product:				
Direct......do....	54, 014, 466	71, 121, 676	76, 882, 338	63. 970. 016
Concentrates......do....	13, 799, 046	17, 058, 162	19, 055, 357	16, 412, 639
Sinter......do....	2, 522, 698	4, 368, 959	4, 585, 799	4, 018, 794
Byproduct material (pyrites cinder and sinter)......gross tons..	506, 903	542, 723	479, 998	535, 998
Total......do....	70, 843, 113	93, 091, 520	101, 003, 492	84, 937, 447
Production by types of ore:				
Hematite......do....	65, 728, 172	84, 535, 465	90, 686, 138	76, 262, 577
Brown ore......do....	686, 402	1, 201, 408	2, 176, 149	1. 545, 595
Magnetite......do....	3, 920, 986	6, 811. 876	7, 661, 207	6, 593. 277
Carbonate......do....	650	48		
Byproduct material (pyrites cinder and sinter)......gross tons..	506, 903	542, 723	479, 998	535, 998
Total......do....	70, 843, 113	93, 091, 520	101, 003, 492	84, 937, 447
Shipments......do....	70, 090, 410	93, 314, 635	100, 821, 714	84, 687, 275
Value......	$215, 006, 427	$320, 864, 981	$394, 460, 751	$381, 515, 831
Average value per ton at mine......	$3. 07	$3. 44	$3. 91	$4. 50
Stocks at mines Dec. 31......gross tons..	5, 339, 147	6, 036, 244	6, 284, 773	5, 333, 660
Imports......do....	2, 754, 216	[2] 4, 895, 652	6, 108, 754	7, 402, 157
Value......	$10, 370, 675	[2] $22, 072, 768	$27, 330, 482	$36, 790, 743
Exports......gross tons..	1, 505, 854	[2] 2, 811, 175	3, 080, 666	2, 424, 777
Value......	$5, 492, 549	[2] $10, 613, 941	$13, 744, 979	$14, 653, 817
Consumption......gross tons..	72, 174, 844	96, 115, 549	100, 498, 557	89, 218, 498
Manganiferous iron ore (5 to 35 percent Mn):				
Shipments......gross tons..	1, 045, 699	1, 048, 531	1, 196, 933	962, 853
Value......	$3, 126, 711	$3, 447, 149	(3)	$4, 040, 155

[1] Direct-shipping ore, washed ore, concentrates, sinter, and byproduct pyrites cinder and sinter.
[2] Revised figure.
[3] Bureau of Mines not at liberty to publish figure.

RESERVES

Reserves of commercial[1] iron ore in the United States on January 1, 1951

[U. S. Geological Survey]

District	Iron, percent (approximate)	Gross tons (measured, indicated, and inferred)
Lake Superior	51.5	3,024,658,000
Northeastern	60	1,110,000,000
Southeastern	35	1,626,700,000
Southern	45	64,200,000
Western	50	610,000,000
Total		6,435,558,000

[1] Material considered usable under present economic and technologic conditions.

PRODUCTION AND SHIPMENTS

Domestic iron-ore mines produced crude ore totaling 104,850,736 gross tons and shipped 104,477,495 tons in 1949, decreases of 17 percent from 1948 in both instances. Of the 1949 shipments, 39 percent went to beneficiating plants and 61 percent went direct to consumers, as in 1948. From the crude ores shipped to beneficiating plants, 16,412,639 tons of concentrates and 4,018,794 tons of sinter were produced. In addition, 535,998 tons of byproduct ore in the form of cinder and sinter were produced by the pyrites industry during 1949. The ore from which this byproduct was produced is not included in the crude ore totals given above. In all, 84,937,447 gross tons of usable iron ore, including byproduct, were produced at mines and mills in 1949, a 16-percent decrease from 1948. Of this quantity, 63,970,016 tons were shipped directly to consumers without beneficiation.

The output in 1949, excluding byproduct material noted above, came from 221 mines, of which 36 mined over 1,000,000 tons of crude ore each. Minnesota, with 55,861,542 tons, and Michigan, second-largest producer, with 11,199,024 tons, supplied 66 and 13 percent, respectively, of the total usable ore in 1949. These two States and Wisconsin, with 1,433,557 tons, constitute the Lake Superior district, which supplied 81 percent of the domestic output.

Open-pit mines provided 74.5 percent of the crude ore mined in 1949 compared with 78.4 percent in 1948. Distribution, percentagewise, of crude-ore production by districts indicates little change from 1948: Less than 0.5 percent in the Southeastern and Northeastern districts, 1 percent gain in the Lake Superior district, and 1 percent decline in the Western district.

Crude iron ore mined in the United States, by States and varieties, 1948–49, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1948						1949					
	Number of mines	Hematite	Brown ore	Magnetite	Total	Rank	Number of mines	Hematite	Brown ore	Magnetite	Total	Rank
Alabama	[1] 22	8,237,409	3,681,648		11,919,057	3	[1] 24	6,811,252	3,525,578		10,336,830	3
California	2	153,684			153,684	12	1	536,525			536,525	12
Georgia	[1] 6		1,368,820		1,368,820	8	[1] 8		1,143,500		1,143,500	9
Michigan	35	13,102,086			13,102,086	2	37	11,199,024			11,199,024	2
Minnesota	123	79,358,278	512,987		79,871,265	1	123	66,479,532	146,936	[2] 47,000	66,673,468	1
Missouri	1	486,808			486,808	11	2	415,454	2,700		418,154	13
Nevada	2			8,945	8,945	13	1			3,094	3,094	14
New Jersey	4			857,444	857,444	9	4			921,422	921,422	10
New York	7	4,122		9,518,233	9,522,355	4	7	3,810		6,047,352	6,051,162	4
Pennsylvania	1						1			1,432,191	1,432,191	8
Texas	4		3,508,843		3,508,843	5	4		1,445,645		1,445,645	6
Utah	3			3,233,413	3,233,413	6	5			2,712,390	2,712,390	5
Virginia	1		4,893		4,893	15	1		4,220		4,220	15
Washington	1	5,364			5,364	14						
Wisconsin	2	1,492,604			1,492,604	7	2	1,433,557			1,433,557	7
Wyoming	1	689,591			689,591	10	1	539,554			539,554	11
Total	215	103,529,946	9,077,191	13,618,035	126,225,172		221	87,418,708	6,268,579	11,163,449	104,850,736	
Percent of total		82.0	7.2	10.8	100.0			83.4	6.0	10.6	100.0	

[1] Excludes an undetermined number of small pits. Output of these pits included in tonnage given.
[2] Approximate figure.

Shipments of usable ore from mines and mills totaled 84,687,275 gross tons in 1949, a 16-percent decrease from 1948. Of this quantity, 63,492,932 tons (75 percent) were direct-shipping ore for use in iron and steel furnaces. Total shipments also include 40,152 tons of ore for cement manufacture, 6,145 tons for paint, and 57,800 tons for miscellaneous purposes (including use as heavy mediums for ore beneficiation). Shipments of byproduct ore for use in iron and steel included in the total shipments amounted to 512,876 tons in 1949, valued at $3,878,700.

Crude iron ore mined in the United States, 1948–49, by States and mining methods in gross tons

State	1948			1949		
	Open pit	Underground	Total	Open pit	Underground	Total
Alabama	4,782,270	7,136,787	11,919,057	3,755,167	6,581,663	10,336,830
California	146,341	7,343	153,684	536,525		536,525
Georgia	1,368,820		1,368,820	1,143,500		1,143,500
Michigan	2,846,204	10,255,882	13,102,086	702,475	10,496,549	11,199,024
Minnesota	77,475,098	2,396,167	79,871,265	63,104,345	3,569,123	66,673,468
Missouri	486,808		486,808	418,154		418,154
Nevada	8,945		8,945	3,094		3,094
New Jersey		857,444	857,444		921,422	921,422
New York }	5,151,263	4,371,092	9,522,355	3,709,424	2,341,738	6,051,162
Pennsylvania }				627,399	804,792	1,432,191
Texas	3,486,503	22,340	3,508,843	1,445,645		1,445,645
Utah	3,233,413		3,233,413	2,712,390		2,712,390
Virginia	4,893		4,893	4,220		4,220
Washington	5,364		5,364			
Wisconsin		1,492,604	1,492,604		1,433,557	1,433,557
Wyoming		689,591	689,591		539,554	539,554
Total	98,995,922	27,229,250	126,225,172	78,162,338	26,688,398	104,850,736
Percent of total	78.4	21.6	100.0	74.5	25.5	100.0

Crude iron ore shipped from mines in the United States, by States and disposition, 1948–49, in gross tons

State	1948			1949		
	Direct to consumers	To beneficiation plants	Total	Direct to consumers	To beneficiation plants	Total
Alabama	5,995,206	5,874,852	11,870,058	5,465,022	4,808,624	10,273,646
California	345,863		345,863	584,109		584,109
Georgia		1,368,820	1,368,820		1,143,500	1,143,500
Michigan	12,896,478		12,896,478	10,993,239		10,993,239
Minnesota	51,669,596	28,176,320	79,845,916	41,592,063	24,941,064	66,533,127
Missouri		486,808	486,808	2,700	415,454	418,154
Nevada	8,945		8,945	3,094		3,094
New Jersey	129,846	706,171	836,017	108,823	788,180	897,003
New York }	186,380	9,370,415	9,556,795	116,488	5,973,867	6,090,355
Pennsylvania }					1,447,313	1,447,313
Texas	16,356	3,490,084	3,506,440	6,668	1,438,977	1,445,645
Utah	3,233,122		3,233,122	2,698,632		2,698,632
Virginia		4,561	4,561		4,349	4,349
Washington	5,364		5,364			
Wisconsin	1,468,953		1,468,953	1,405,775		1,405,775
Wyoming	689,591		689,591	539,554		539,554
Total	76,645,700	49,478,031	126,123,731	63,516,167	40,961,328	104,477,495
Percent of total	60.8	39.2	100.0	60.8	39.2	100.0

Iron ore mined in the United States, by mining districts and varieties, 1948–49, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

Variety of ore	Lake Superior district	Southeastern States	Northeastern States	Western States	Total
1948					
Crude ore:					
Hematite	93,952,968	8,237,409	4,122	1,335,447	103,529,946
Brown ore	[1] 512,987	5,055,361		3,508,843	9,077,191
Magnetite			10,375,677	3,242,358	13,618,035
Total	94,465,955	13,292,770	10,379,799	8,086,648	126,225,172
Usable iron ore:					
Hematite	82,277,451	7,390,600	4,122	1,013,965	90,686,138
Brown ore	[1] 352,979	974,790		848,380	2,176,149
Magnetite			4,418,849	3,242,358	7,661,207
Total	82,630,430	8,365,390	4,422,971	5,104,703	100,523,494
1949					
Crude ore:					
Hematite	79,112,113	6,811,252	3,810	1,491,533	87,418,708
Brown ore	[1] 146,936	4,673,298		1,448,345	6,268,579
Magnetite	[2] 47,000		8,400,965	2,715,484	11,163,449
Total	79,306,049	11,484,550	8,404,775	5,655,362	104,850,736
Usable iron ore:					
Hematite	68,376,209	6,666,644	1,796	1,217,928	76,262,577
Brown ore	[1] 102,158	935,178		508,259	1,545,595
Magnetite	15,756		3,862,037	2,715,484	6,593,277
Total	68,494,123	7,601,822	3,863,833	4,441,671	84,401,449

[1] Produced in Fillmore County—not in the true Lake Superior district.
[2] Approximate figure.

PRINCIPAL MINES

An accompanying table lists in descending order, with pertinent details, the iron mines of the United States that produced over 500,000 gross tons of crude ore each in 1949. The order of listing is based on ore tonnage, not iron content of product; thus mines producing low-grade crude ore that requires concentration are considered comparable in size to mines producing similar tonnages of direct-shipping ore.

Thirty-six mines, each producing more than 1,000,000 tons of crude ore, supplied 57 percent of the United States output in 1949. Of these, 24 are in Minnesota, 5 in Alabama, 3 in New York, and 1 each in Michigan, Pennsylvania, Texas, and Utah; 28 were open-pit mines, 6 were underground, and 2 combined operations. Except for 4 mines that produced magnetite, 1 producing semialtered magnetite, and 2 producing brown ore, all of the million-ton mines produced hematite in 1949. In 1948, 36 mines producing more than 1,000,000 gross tons of crude ore each supplied 60 percent of the total domestic output.

Twenty-eight mines producing 500,000 to 1,000,000 gross tons of crude ore each supplied 17 percent of the United States total output in 1949. Of these, 14 are in Minnesota, 5 in Michigan, 2 each in Alabama and Utah, and 1 each in California, New Jersey, New York, Wisconsin, and Wyoming. Seventy-four percent of the total domestic output of crude ore came from the 64 mines listed in the accompanying table.

Iron ore produced in the United States, by States and types of product, 1948–49, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1948 Direct shipping ore	1948 Sinter [1]	1948 Concentrates	1948 Total	1948 Iron content, natural (percent)	1949 Direct shipping ore	1949 Sinter [1]	1949 Concentrates	1949 Total	1949 Iron content, natural (percent)
Mined ore:										
Alabama	6,045,212	1,195,724	847,728	8,088,664	38.28	5,522,190	1,143,126	703,468	7,368,784	36.47
California	153,684			153,684	54.86	536,525			536,525	55.58
Georgia			273,735	273,735	42.26			228,689	228,689	42.10
Michigan	13,102,086			13,102,086	49.26	11,199,024			11,199,024	53.03
Minnesota	51,812,962	256,000	15,966,778	68,035,740	49.86	41,788,857	260,403	13,812,282	55,861,542	50.25
Missouri			165,326	165,326	52.11	2,700		141,849	144,549	51.80
Nevada	8,945			8,945	65.00	3,094			3,094	65.00
New Jersey	129,709		306,858	436,567	63.97	108,896		339,915	448,811	63.01
New York	186,330	3,041,639	758,435	3,986,404	62.50	116,561	1,932,315	415,170	2,464,046	62.59
Pennsylvania	—	—	—	—	56.00		622,268	328,708	950,976	57.73
Texas	22,438	92,436	733,506	848,380	41.19	6,668	60,682	438,209	505,559	44.55
Utah	3,233,413			3,233,413	53.93	2,712,390			2,712,390	53.66
Virginia			2,991	2,991	35.01			4,349	4,349	32.00
Washington	5,364			5,364	56.50					
Wisconsin	1,492,604			1,492,604	52.84	1,433,557			1,433,557	52.88
Wyoming	689,591			689,591	47.00	539,554			539,554	49.14
Total mined ore	76,882,338	4,585,799	19,055,357	100,523,494	49.51	63,970,016	4,018,794	16,412,639	84,401,449	50.06
Byproduct ore: [2]										
Delaware		479,998		479,998	68.49		535,998		535,998	61.95
Tennessee		—		—	56.99		—		—	68.40
Virginia		—		—	62.59		—		—	57.00
Total byproduct ore		479,998		479,998	67.02		535,998		535,998	66.10
Grand total	76,882,338	5,065,797	19,055,357	101,003,492	49.59	63,970,016	4,554,792	16,412,639	84,937,447	50.16

[1] Exclusive of sinter produced at consuming plants.
[2] Cinder and sinter obtained from pyrites treated in, but not necessarily mined in, States indicated.

Iron ore produced in the United States, by States and varieties, 1948–49, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1948				1949			
	Hematite	Brown ore	Magnetite	Total	Hematite	Brown ore	Magnetite	Total
Alabama	7,390,600	698,064		8,088,664	6,666,644	702,140		7,368,784
California	153,684			153,684	536,525			536,525
Georgia		273,735		273,735		228,689		228,689
Michigan	13,102,086			13,102,086	11,199,024			11,199,024
Minnesota	67,682,761	352,979		68,035,740	55,743,628	102,158	15,756	55,861,542
Missouri	165,326			165,326	141,849	2,700		144,549
Nevada			8,945	8,945			3,094	3,094
New Jersey			436,567	436,567			448,811	448,811
New York	4,122		3,982,282	3,986,404	1,796		2,462,250	2,464,046
Pennsylvania							950,976	950,976
Texas		848,380		848,380		505,559		505,559
Utah			3,233,413	3,233,413			2,712,390	2,712,390
Virginia		2,991		2,991		4,349		4,349
Washington	5,364			5,364				
Wisconsin	1,492,604			1,492,604	1,433,557			1,433,557
Wyoming	689,591			689,591	539,554			539,554
Total	90,686,138	2,176,149	7,661,207	100,523,494	76,262,577	1,545,595	6,593,277	84,401,449
Byproduct ore:[1]								
Delaware								
Tennessee				479,998				535,998
Virginia								
Grand total	90,686,138	2,176,149	7,661,207	101,003,492	76,262,577	1,545,595	6,593,277	84,937,447

[1] Cinder and sinter obtained from pyrites treated in, but not necessarily mined in, States indicated.

Shipments of iron ore in the United States in 1949, by States and uses, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	Iron and steel			Cement	Paint	Miscellaneous	Total	
	Direct shipping ore	Sinter[1]	Concentrates				Gross tons	Value
Mined ore:								
Alabama	5,465,022	1,142,371	706,811				7,314,204	$27,553,175
California	575,050			7,619		1,440	584,109	(2)
Georgia			228,689				228,689	692,649
Michigan	10,993,239						10,993,239	55,237,126
Minnesota	41,592,063	260,403	14,091,248				55,943,714	239,858,902
Missouri	2,700		141,849				144,549	(2)
Nevada	3,094						3,094	(2)
New Jersey	108,612		327,347	12,170		360	448,489	4,468,575
New York	116,488	1,931,374	232,462	10,475	1,796	51,923	2,344,518	22,184,757
Pennsylvania		622,268	330,494				952,762	9,324,197
Texas	2,659	77,251	484,803	4,009			568,722	(2)
Utah	2,688,676			5,879		4,077	2,698,632	4,403,767
Virginia					4,349		4,349	(2)
Wisconsin	1,405,775						1,405,775	(2)
Wyoming	539,554						539,554	(2)
Undistributed								[2] 13,913,983
Total	63,492,932	4,033,667	16,543,703	40,152	6,145	57,800	84,174,399	377,637,131
Byproduct ore:[3]								
Delaware								
Tennessee		512,876					512,876	3,878,700
Virginia								
Grand total	63,492,932	4,546,543	16,543,703	40,152	6,145	57,800	84,687,275	381,515,831

[1] Exclusive of sinter produced at consuming plants.
[2] Values that may not be shown separately are combined as "Undistributed."
[3] Cinder and sinter obtained from pyrites treated in, but not necessarily mined in, States indicated.

Iron-ore mines in the United States in 1949, by size of crude output

Name of mine	State	Nearest town	Range or district	Mining method	Production (gross tons)	
					Crude ore	Usable ore
Hull-Rust	Minnesota	Hibbing	Mesabi	Open pit	6, 463, 974	6, 195, 649
Rouchleau	do	Virginia	do	do	3, 824, 277	3, 824, 277
Mahoning	do	Hibbing	do	do	2, 740, 216	2, 740, 216
Monroe-Tener	do	Chisholm	do	do	2, 616, 567	2, 590, 277
Sherman	do	Fraser	do	do	2, 613, 188	2, 586, 819
Benson	New York	Star Lake	Adirondack	do	2, 309, 770	840, 378
Mountain Iron	Minnesota	Virginia	Mesabi	do	2, 280, 503	2, 280, 503
Gross Marble	do	Marble	do	do	1, 885, 052	1, 007, 756
Walker	do	Coleraine	do	do	1, 787, 798	1, 169, 208
Iron Mountain	Utah	Cedar City	Iron Mountain.	do	1, 633, 353	1, 633, 353
Wenonah	Alabama	Bessemer	Birmingham	Underground	1, 630, 163	1, 594, 430
Ishkooda	do	do	do	do	1, 445, 935	1, 415, 935
Cornwall-Lebanon concentrator.	Pennsylvania	Lebanon	Cornwall	Combined	1, 432, 191	950, 976
Kevin	Minnesota	Copley	Mesabi	Open pit	1, 419, 734	490, 867
Hill-Trumbull	do	Marble	do	do	1, 387, 562	534, [illegible]71
Gilbert	do	Gilbert	do	do	1, 380, 239	1, 380, 239
Hill-Annex	do	Calumet	do	do	1, 355, 527	842, 244
Muscoda	Alabama	Bessemer	Birmingham	Underground	1, 339, 169	1, 311, 169
MacIntyre	New York	Tahawus	Adirondack	Open pit	1, 329, 004	507, 106
Pillsbury	Minnesota	Balkan	Mesabi	do	1, 321, 400	1, 321, 400
Mississippi	do	Keewatin	do	do	1, 286, 264	1, 132, 538
New Bed Harmony and Old Bed.	New York	Mineville	Adirondack	Underground	1, 286, 261	733, 594
Scranton	Minnesota	Hibbing	Mesabi	Open pit	1, 277, 802	1, 277, 802
Spruce	do	Eveleth	do	Combined	1, 231, 555	1, 231, 555
Holman-Brown	do	Taconite	do	Open pit	1, 155, 178	707, 756
Lone Star	Texas	Daingerfield.	East Texas	do	1, 151, 515	271, 249
Adkins	Alabama	Woodstock	Birmingham	do	1, 111, 600	222, 326
Canisteo	Minnesota	Coleraine	Mesabi	do	1, 108, 338	565, 072
Hawkins	do	Nashwauk	do	do	1, 095, 898	604, 928
Canton	do	Biwabik	do	do	1, 094, 900	1, 094, 90[illegible]
Embarrass	do	do	do	do	1, 062, 892	1, 062, 892
Mather	Michigan	Ishpeming	Marquette	Underground	1, 062, 164	1, 062, 164
Pyne	Alabama	Bessemer	Birmingham	do	1, 053, 624	1, 053, 624
Halobe	Minnesota	Nashwauk	Mesabi	Open pit	1, 023, 625	335, 791
Buckeye	do	Coleraine	do	do	1, 022, 440	624, 052
Susquehanna	do	Hibbing	do	do	1, 019, 787	923, 101
Montreal	Wisconsin	Montreal	Gogebic	Underground	962, 119	962, 119
Arcturas	Minnesota	Marble	Mesabi	Open pit	865, 084	404, 380
Fayal	do	Eveleth	do	Combined	860, 245	860, 245
Chateaugay	New York	Lyon Mountain.	Adirondack	do	831, 275	241, 378
Danube	Minnesota	Bovey	Mesabi	Open pit	752, 547	505, 021
Longyear	do	Hibbing	do	do	747, 218	659, 359
Russellville No. 14	Alabama	Russellville	Russellville	do	742, 253	142, 286
Portsmouth Group	Minnesota	Crosby	Cuyuna	do	665, 369	510, 441
Warner-Auxford	Alabama	Russellville	Russellville	do	650, 000	130, 449
Mott	Minnesota	Mt. Iron	Mesabi	do	648, 758	648, 758
Pioneer	do	Ely	Vermilion	Underground	631, 104	631, 104
Maas	Michigan	Negaunee	Marquette	do	603, 306	603, 306
Bennett	Minnesota	Keewatin	Mesabi	Combined	601, 552	555, 533
Columbia	do	Virginia	do	Open pit	599, 902	581, 692
Galbraith	do	Nashwauk	do	do	571, 720	320, 817
Geneva	Michigan	Ironwood	Gogebic	Underground	554, 029	554, 029
Anvil-Palms-Keweenaw.	do	Bessemer	do	do	550, 697	550, 697
Athens	do	Negaunee	Marquette	do	550, 000	550, 000
Sunrise	Wyoming	Sunrise	Hartville	do	539, 554	539, 554
Eagle Mountain	California	Desert Center.	Eagle Mountain.	Open pit	536, 525	536, 525
Scrub Oaks	New Jersey	Dover	N. J. & SE. N. Y.	Underground	533, 063	184, 324
Excelsior	Utah	Cedar City	Iron Mountain.	Open pit	533, 025	533, 025
Blowout	do	do	do	do	526, 785	526, 785
Webb	Minnesota	Hibbing	Mesabi	do	521, 574	492, 466
Weggum	do	do	do	do	520, 611	368, 473
Godfrey	do	Chisholm	do	Underground	517, 119	517, 119
Patrick Annex	do	Nashwauk	do	Open pit	504, 641	174, 232
Penokee	Michigan	Ironwood	Gogebic	Underground	503, 210	503, 210
Output of 64 mines producing more than 500,000 tons of crude ore each					77, 862, 750	61, 909, 344
Output of 17 mines producing 400,000 to 500,000 tons of crude ore each					7, 869, 809	6, 752, 154
Output of 17 mines producing 300,000 to 400,000 tons of crude ore each					[illegible]	[illegible]
Output of 22 mines producing 200,000 to 300,000 tons of crude ore each					5, 277, 539	4, 051, 110
Output of 35 mines producing 100,000 to 200,000 tons of crude ore each					5, 251, 777	[illegible]
Output of 17 mines producing 50,000 to 100,000 tons of crude ore each					1, 331, 642	[illegible]
Output of 49 mines producing under 50,000 tons of crude ore each					1, 264, 038	[illegible]
Grand total United States (221 mines)					[illegible]	[illegible]

SINTER

Domestic sintering plants in 1949 used 11,869,127 gross tons of iron ore, 4,230,262 tons of flue dust, 559,051 tons of pyrites cinder, 7,413 tons of manganiferous ore, and 409,852 tons of mill cinder and roll scale to produce 15,374,026 gross tons of sinter, a conversion yield of 90 percent.

Sinter production in 1949 came from plants at mines, blast-furnace plants, and custom mills. Of the sinter produced in the United States, 26 percent was made at mine plants in 5 States, and 74 percent was produced at blast-furnace plants and custom mills in 14 States.

Production and consumption of sinter in the United States in 1949, by States, in gross tons

State	Sinter produced	Sinter consumed—	
		In blast furnaces	In steel furnaces
Alabama	1,343,313	1,482,232	82,999
California			
Colorado	970,648	976,626	-----
Utah			
Delaware	61,245	-----	-----
Illinois	673,821	669,229	-----
Indiana	977,167	682,805	309,162
Maryland	-----		
Kentucky			
Tennessee	482,814	479,866	30,217
West Virginia			
Michigan	326,996	327,238	-----
Minnesota	260,403	-----	-----
New York	3,009,558	982,140	52,902
Ohio	2,983,509	3,098,164	318,455
Pennsylvania	4,223,870	3,962,907	145,324
Texas	60,682	77,250	-----
Total	15,374,026	12,738,457	939,059

REVIEW OF LAKE SUPERIOR DISTRICT

Production and Shipments.—Usable iron ore produced from mines and mills in the Lake Superior district totaled 68,391,965 gross tons in 1949. The decline (17 percent) from the high total of 1948 was attributable to the same factors affecting the United States iron-ore industry mentioned in the General Summary. The district—which includes the Marquette, Menominee, Gogebic, Vermilion, Mesabi, and Cuyuna ranges—supplied 81 percent of all domestic iron ore, with 62 percent supplied by the Mesabi range alone. In addition, 102,158 tons of brown-ore concentrates were produced and shipped from Fillmore County, southern Minnesota, which is not considered part of the true Lake Superior district, and 862,361 tons of ore containing (natural) more than 5 percent manganese (all from Minnesota) were produced. Including these last tonnages, output for the district, all grades, totaled 69,356,484 tons. Shipments from the district totaled 69,226,837 tons, of which 69,124,679 tons (including 884,109 tons of manganiferous ore) came from the six ranges and 102,158 tons from Fillmore County, Minn.

Production and shipments from Canadian mines in the Lake Superior district are not included in the above statistics. Shipments from these mines in 1949 totaled 1,796,000 tons. Of this quantity,

662,000 tons came from the Helen mine in the Michipicoten district, and 1,134,000 tons were shipped from the Steep Rock mine in the Steep Rock district. The Lake Superior Iron Ore Association reported 67,800,229 gross tons of iron and manganiferous ores shipped to upper Lake ports from United States mines in 1949, or 17 percent below 1948. All-rail shipments totaled 1,428,416 tons in 1949 compared with 1,745,397 tons in 1948.

The 1949 Lake shipping season opened March 27 and closed December 4, several days longer than the average season, although approximately 43 days of shipping were lost during the steel strike. The season opened strongly, and shipping continued at a high rate until reduced consumption by furnaces made itself felt about midsummer. The entire decrease from the 1948 total occurred in the latter part of the season, the bulk of the tonnage being lost during the strike. Had the strike been averted, a record stockpile of ore might have accumulated at lower Lake ports and consumers' yards.

Iron mines in the Spring Valley area in Fillmore County, southern Minnesota, produce brown-ore concentrates from a bog type of limonite of different origin and mineral character than the Lake Superior ores. Washing is the principal means of beneficiation, and all the concentrates are shipped by rail to Granite City, Ill.

Iron ore produced in the Lake Superior district, 1854–1949, by ranges, in gross tons

[Exclusive after 1905 of ore containing 5 percent or more manganese]

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1854–1944	229,773,915	205,736,670	242,702,380	75,704,578	1,376,030,818	32,807,310	2,162,755,671
1945	4,664,816	4,140,239	4,395,653	1,481,007	58,355,320	1,784,010	74,821,045
1946	3,455,961	2,662,308	3,633,078	1,232,008	46,678,679	1,380,120	59,042,154
1947	5,070,631	3,741,217	5,227,005	1,471,879	58,772,404	2,100,846	76,383,982
1948	4,830,341	4,259,378	5,504,971	1,580,497	64,071,963	2,030,281	82,277,451
1949	4,392,732	3,483,375	4,756,474	1,381,327	52,551,346	1,826,711	68,391,965
Total	252,188,396	224,023,187	266,219,561	82,851,296	1,656,460,550	41,929,278	2,523,672,268

Technologic Developments.—As in recent years, research efforts in 1949 were directed toward economic beneficiation of low-grade ores to a product acceptable for blast-furnace use. Current beneficiation methods have been reviewed.[1,2] Ore types at present capable of profitable beneficiation include "ore fines," which are high enough in iron content but require sintering or pelletizing to suitable physical character; "wash ore," which requires only simple crushing, sizing and washing, and jig or heavy-medium ores which require means to remove rocks of varying sizes. Taconite, the hard, iron-bearing rock that is receiving the most attention at research laboratories, cannot yet be included with ores profitably beneficiated. Progress is being made, and in 1949 more than 15,000 tons were produced in the preliminary plant of the Erie Mining Co. near Aurora, Minn. The flow sheet used in this plant was published.[3]

[1] Tartaron, Francis X., Beneficiation of Northern Iron Ore: Iron and Steel Eng., vol. 26, No. 12, December 1949, pp. 113–118.

[2] Holt, Grover J., Beneficiation of Iron Ore: Blast Furnace and Steel Plant, vol. 37, No. 9, September 1949, pp. 1061–1066.

[3] Engineering and Mining Journal, Taconite Flow Sheet at Aurora Is Disclosed: Vol. 150, No. 11, November 1949, p. 110.

Skillings' Mining Review, Erie Mining Co. Continues Taconite Research on Mesabi Iron Ranges: Vol. 38, No. 28, Oct. 22, 1949, pp. 1–2.

Improvements in underground methods are exemplified by plans of the Cleveland-Cliffs Iron Mining Co. to install a belt conveyor for lifting ore in the Cambria-Jackson mine at Negaunee, Mich. This conveyor will accomplish a vertical lift of 110 feet with a belt 594 feet long on a 15° incline. Increased mechanization is proving the best means of reducing the costs of underground mining.

Analyses.—The following table shows the average analyses of all ore shipped from the Lake Superior district during the past 5 years. Again, in 1949, slightly increased percentages of silica, phosphorus, and manganese are noted, with gradual decline of average iron content.

Average analyses of total tonnages (bill-of-lading weights) of all grades of iron ore from all ranges of Lake Superior district, 1945–49

[Lake Superior Iron Ore Association]

Year	Gross tons	Content (natural), percent				
		Iron	Phosphorus	Silica	Manganese	Moisture
1945	75, 206, 781	51. 69	0. 089	8. 52	0. 72	10. 96
1946	58, 975, 188	51. 32	. 087	8. 83	. 74	11. 22
1947	77, 210, 278	50. 91	. 093	9. 09	. 75	11. 28
1948	82, 655, 757	50. 49	. 093	9. 30	. 76	11. 35
1949	68, 531, 664	50. 39	. 096	9. 72	. 78	11. 12

Reserves.—The following tables show reserves of iron ore in Michigan and Minnesota by ranges. It should be borne in mind that these data represent only taxable and State-owned reserves and do not represent the total that may be expected to become available. Tonnages are added to the reserve figures each year, and undoubtedly eventual production in the Lake Superior district will greatly exceed that indicated by present reserve tonnages.

Iron-ore reserves in Michigan, Jan. 1, 1946–50, in gross tons

[Michigan Department of Conservation]

Range	1946	1947	1948	1949	1950
Gogebic	31, 828, 392	31, 331, 775	31, 937, 142	30, 511, 502	29, 098, 914
Marquette	51, 648, 430	62, 228, 925	66, 636, 928	67, 101, 475	65, 109, 601
Menominee	48, 260, 784	49, 298, 678	51, 462, 819	55, 913, 371	55, 594, 843
Total Michigan	131, 737, 606	142, 859, 378	150, 036, 889	153, 526, 348	149, 803, 358

Unmined iron-ore reserves in Minnesota, May 1, 1945–49, in gross tons

[Minnesota Department of Taxation]

	1945	1946	1947	1948	1949
Mesabi	962, 290, 748	924, 903, 098	922, 401, 348	915, 220, 248	900, 959, 665
Vermilion	12, 349, 903	11, 523, 341	10, 699, 576	10, 435, 800	12, 196, 016
Cuyuna	59, 659, 027	59, 061, 587	55, 756, 200	38, 040, 129	37, 308, 274
Total Lake Superior district (taxable)	1, 034, 299, 678	995, 488, 026	988, 857, 124	963, 696, 177	950, 463, 955
Fillmore County			186, 700	394, 248	547, 744
State ore (not taxable)	19, 865, 715	19, 950, 255	11, 600, 524	3, 515, 084	2, 435, 729
Total Minnesota	1, 054, 165, 393	1, 015, 438, 281	1, 000, 644, 348	967, 605, 509	953, 447, 428

MINING BY STATES

Alabama.—Production of usable iron ore in Alabama, the third largest producing State, decreased only 9 percent below 1948, compared with 18 percent in Minnesota and 15 percent in Michigan. Output of red ore, virtually all from underground mines, fell 10 percent, while that of brown, all from open-pit mines, increased 1 percent. The active underground red-ore or hematite mines in Alabama are in Jefferson County near Birmingham. Operations extend as much as 2 miles down the incline of the Red Mountain iron formation, which outcrops below Birmingham and dips southeast. Ore from the southwest end of operations runs high in lime and grades down in lime and up in silica and alumina to the northeast. Blending is necessary to permit use of the acid ores. The Tennessee Coal, Iron & Railroad Co., the largest operator, shipped red ore from its Red Mountain mines—the Muscoda, Ishkooda, and Wenonah groups. After crushing and blending, four-fifths of this ore was shipped direct, and the balance was sintered. Woodward Iron Co. shipped ore direct from its Pyne, Songo, and Red Ore underground mines. Sloss-Sheffield Steel & Iron Co. shipped red hematite from its Ruffner and Sloss underground mines and brown-ore concentrates from its Russellville No. 14 open-pit mine. Republic Steel Corp. shipped direct from its Edwards mine (underground) and sintered the production of its Spaulding mine (underground and open pit). Approximately 20 non-consuming operators shipped brown-ore concentrates from various open-pit mines in 8 counties. The largest of these was the Shook & Fletcher Supply Co. of Birmingham. The weighted average grade of hematite shipped from Alabama mines and mills during 1949 was 35.77 percent Fe (natural).

All of the brown ore produced in Alabama in 1949 was wash concentrate from open-pit mines.

California.—The Eagle Mountain mine of the Kaiser Steel Corp. operated full time in 1949, with all its production going to the Fontana furnaces. The Vulcan mine in San Bernardino County did not operate but shipped 55,883 tons from stocks.

Georgia.—Iron-ore production of Georgia consisted entirely of washed brown-ore concentrates from open-pit mines in the northwest portion of the State. Bartow, Cherokee, and Polk were the only counties reporting production in 1949. The Hodge Mining Co., Cartersville, Ga., was the largest producer in 1949.

Michigan and Minnesota.—See Review of Lake Superior district.

Missouri.—The Iron Mountain open-pit mine in St. Francois County, operated by the Ozark Ore Co., produced hematite concentrates averaging 51.97 percent Fe (natural). Beneficiation consisted of crushing and jigging. Brown ore was shipped from various small surface operations in Wayne County by Doane and Ives of Poplar Bluff, Mo.

Nevada.—The only production of iron ore reported from Nevada in 1949 was that of Segerstrom & Heizer, Lovelock, Nev.

New Jersey.—The Oxford and Wharton districts of New Jersey were the only producers in 1949. In the Oxford district, the Alan Wood Steel Co., produced magnetite concentrates from the Washington mine. In the Wharton district, the Alan Wood Steel Co. operated

the Scrub Oaks mine, the Richard Ore Co. the Richard mine, and the Warren Pipe & Foundry Corp. the Mount Hope mine. Some lump and coarse ore was shipped direct to steel furnaces, but the greater part of shipments consisted of magnetite concentrates beneficiated by magnetic and gravity methods. A small amount of New Jersey ore was employed in making cement and for miscellaneous uses. The average iron content in 1949 was 63 percent.

Iron ore mined in the United States in 1949, by States and counties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State and county	Active mines	Crude ore	Usable ore
Alabama:			
Bibb	1	1,111,600	222,326
Calhoun	[1] 1	338,742	69,885
Cherokee	[1] 3	191,025	38,233
Franklin	[1] 2	1,611,253	316,431
Jefferson	13	6,806,936	6,662,328
St. Clair	[1] 1	3,432	3,432
Shelby	[1] 1	28,000	5,614
Talladega	[1] 2	245,842	50,535
Total	24	10,336,830	7,368,784
California: Riverside	1	536,525	536,525
Georgia:			
Bartow	[1] 4	297,500	59,889
Cherokee	[1] 2	310,000	61,775
Polk	[1] 2	536,000	107,025
Total	8	1,143,500	228,689
Michigan:			
Dickinson	2	50,708	50,708
Gogebic	15	3,322,917	3,322,917
Iron	13	3,432,667	3,432,667
Marquette	7	4,392,732	4,392,732
Total	37	11,199,024	11,199,024
Minnesota:			
Crow Wing	11	2,166,697	1,826,711
Fillmore	1	146,936	102,158
Itasca	31	20,127,723	11,395,426
St. Louis	80	44,232,112	42,537,247
Total	123	66,673,468	55,861,542

State and county	Active mines	Crude ore	Usable ore
Missouri:			
St. Francois	1	415,454	141,849
Wayne	[1] 1	2,700	2,700
Total	2	418,154	144,549
Nevada: Pershing	1	3,094	3,094
New Jersey:			
Morris	3	921,422	448,811
Warren	1		
Total	4	921,422	448,811
New York:			
Clinton	1		
Essex	3	3,645,513	1,534,474
Oneida	1		
St. Lawrence	2	2,405,649	929,572
Total	7	6,051,162	2,464,046
Pennsylvania: Lebanon	1	1,432,191	950,976
Texas:			
Cass	1		
Cherokee	2	1,445,645	505,559
Morris	1		
Total	4	1,445,645	505,559
Utah: Iron	5	2,712,390	2,712,390
Virginia: Pulaski	1	4,220	4,349
Wisconsin: Iron	2	1,433,557	1,433,557
Wyoming: Platte	1	539,554	539,554
Grand total	221	104,850,736	84,401,449

[1] Excludes undetermined number of small pits. Estimated output of these mines included in tonnage given.

New York.—Operations in the Adirondack district of upper New York State included underground mines of the Republic Steel Corp.—the New Bed-Harmony-Old Bed group and Fisher Hill at Mineville in Essex County, and the Chateaugay mine at Lyon Mountain, Clinton County; Hanna Coal & Ore Corp. Clifton mine at Degrasse, St. Lawrence County; Jones & Laughlin Ore Co. Benson mine at Star Lake, St. Lawrence County; and the National Lead Co. MacIntyre development at Tahawus, Essex County. In addition, a small quantity of Clinton hematite was mined in Oneida County for use in pigments.

The Adirondack ores are magnetite with associated nonmagnetic martite in the Star Lake area. Titaniferous magnetite is mined from

the MacIntyre development. Shipments consisted mainly of sintered concentrates (in 1949, 82 percent), only 13 percent of the 1949 concentrates being shipped without sintering. Of these unsintered concentrates, 79 percent was used to make iron and steel; and other uses were as components of heavy mediums, refractories, and cement.

Pennsylvania.—Bethlehem Steel Corp. produced magnetite from underground and open-pit mines at Cornwall, Pa., during 1949. All of the mine output was concentrated, and two-thirds of the concentrates were sintered at Lebanon.

Texas.—The Lone Star Steel Co., principal producer, mined brown ore from open pits in the Daingerfield area, Morris County. Beneficiation consisted of washing, calcining, and sintering. Sheffield Steel Co. operated two open-pit brown-ore mines: The North Basin at Linden, Cass County, and the Mount Haven at Jacksonville, Cherokee County. The Valencia Iron & Chemical Co. operated surface mines near Rusk, Cherokee County.

Utah.—The Cedar City area in Iron County produced a direct-shipping semialtered magnetite averaging 53.3 percent Fe in 1949. The Columbia Iron Mining Co. worked the Iron Mountain mine; Colorado Fuel & Iron Corp., the Blowout and the Duncan mines; Utah Construction Co., the Excelsior; and Helene E. Beatty, the Great Western. Ore from this area serves three iron- and steel-making centers—Geneva and Provo in Utah; Pueblo, Colo.; and Fontana, Calif.

Virginia.—A small quantity of iron ore was mined by open-pit methods in Pulaski County during 1949 for use as pigment.

Wisconsin.—See Review of Lake Superior district.

Wyoming.—Colorado Fuel & Iron Corp. produced direct-shipping hematite from underground operations at the Sunrise mine in the Hartville district, Platte County; shipments averaged 49 percent Fe (natural).

CONSUMPTION

Consumers of iron ore reported 89,218,498 gross tons used in 1949, a decrease of 11 percent from 1948. Distribution by types of consumers indicates no change from 1948: Blast furnaces 82 percent, sintering plants 13 percent, steel furnaces 4 percent, and ferro-alloy furnaces, cement plants, pigments, and other items 1 percent. In addition to the iron ore used, blast furnaces consumed 12,738,457 tons and steel furnaces 939,059 tons of sinter.

STOCKS

Stocks of usable iron ore at mines on December 31, 1949, were 15 percent below 1948. Of the quantity in stockpiles, 38 percent was at mines in Michigan, 29 percent in Minnesota, and 24 percent in New York. Including Wisconsin, the Lake Superior district held 69 percent of the total stocks at the end of the year. Stocks of crude ore at mines totaled 3,335,095 gross tons on December 31, 1949, compared with 4,662,648 tons at the end of 1948.

Stocks of iron ore, including sinter, at consuming plants totaled 37,023,767 gross tons on December 31, 1949, compared with 37,144,933 tons at the end of 1948.

Consumption of iron ore in the United States in 1949, by States and uses, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	Metallurgical uses				Miscellaneous uses			Total[1]
	Iron blast furnaces	Steel furnaces	Sintering plants	Ferro-alloy furnaces	Cement	Paint	Other	
Alabama	6,275,747	13.874	1,342,307		71,439			7,703,367
California					29,945	(2)	1,440	
Colorado	2,279,537	226,309	1,030,157	4,077				3,577,448
Utah					5,983			
Illinois	7,472,651	309,705	329,889		314	(2)		8,112,559
Indiana	9,457,966	392,034	541,083	3,571				10,394,654
Kentucky	876,379	48,665						925,044
Maryland						(2)		
Massachusetts	6,138,526	540,602	188,121					6,867,249
Michigan								
Minnesota	821,329	54,922	339,840					1,216,091
New Jersey						(2)	(2)	(2)
New York	4,310,282	311,833	2,588,660	99,295	10.310	(2)	(2)	7,320,380
Ohio	13,305,087	584,710	3,136,344	125,585	2,248	(2)		17,153,974
Pennsylvania	19,259,350	1,306,396	2,226,873	6,211	21,218	29,943		22,849,991
Tennessee	29,177		73,756		7,653			110,586
Texas	645,527	220	72,097		26,896			744,740
Virginia						(2)		(2)
West Virginia	2,093,659	14,678			206			2,108,543
Undistributed[3]					31,506	50,083	52,283	133,872
Total	72,965,217	3,803,948	11,869,127	238,739	207,718	80,026	53,723	89,218,498

[1] State totals include only tonnages shown. Other tonnages included with "Undistributed."
[2] Included with "Undistributed."
[3] Includes States indicated by footnote 2 plus the following: For cement, Arkansas, Florida, Kansas, Louisiana, Missouri, Montana, Oklahoma, Oregon, and Washington; and for paint, Georgia, North Dakota, and Wisconsin.

Stocks at Lake Erie Ports.—On December 1, 1949, 4 days before the last ship of the season was loaded at an upper Lake port, the Lake Superior Iron Ore Association reported 6,938,595 tons of iron ore on Lake Erie docks compared with 5,689,828 in 1948. At the opening of the 1950 season (May 1, 1950), 3,065,827 tons of ore were in stock at these ports, compared with 2,033,169 tons on May 1, 1949. Thus, withdrawals from stock during the 5-month period 1949–50 were 6 percent more than during the previous year.

Stocks of usable iron ore at mines, Dec. 31, 1948–49, by States, in gross tons

State	1948	1949	State	1948	1949
Alabama	102,493	157,073	Texas	130,645	61,400
California	152,480	106,282	Utah	17,943	31,701
Michigan	1,803,304	2,005,255	Wisconsin	97,085	124,867
Minnesota	3,296,825	1,561,328			
New Jersey	1,536	1,852	Total	6,284,773	5,333,660
New York	682,468	1,278,545			
Pennsylvania		5,357			

PRICES[4]

Value at Mine.—The average value per gross ton of iron ore f. o. b. mines and mills was $4.50 in 1949 compared with $3.91 in 1948 and $3.44 in 1947, an increase of 31 percent in 3 years. However, during the period 1939–49, iron ore has increased 56 percent in value, while

[4] For an explanation of the factors affecting the price of iron ore, see Minerals Yearbook, 1948, p. 647.

the wholesale price index [5] for all commodities increased 101 percent.

The accompanying table gives the average value at mines of the different classes of iron ore in 1949 for each of the producing States or groups of States, except where there are fewer than three shippers of a certain class of ore in a State and permission has not been given to publish the value. These data are taken directly from statements of producers and probably represent the commercial selling prices only approximately. In general, the delivered cost less transportation costs to the consuming plants is given. In the Lake Superior district the mine value is the Lake Erie price less freight from mines to lower Lake ports. This value appears to be applied also to ore that is not sold on the open market.

Average value per gross ton of iron ore at mines in the United States, 1948–49

[Exclusive of ore containing 5 percent or more manganese]

State	1948							1949						
	Direct			Concentrates				Direct			Concentrates			
	Hematite	Brown ore	Magnetite	Hematite	Brown ore	Magnetite	Sinter	Hematite	Brown ore	Magnetite	Hematite	Brown ore	Magnetite	Sinter
Mined ore:														
Alabama	$3.61	-----	-----	(1)	$3.22	-----	(1)	$3.48	-----	-----	-----	$3.75	-----	(1)
Georgia	-----	-----	-----	-----	2.73	-----	-----	-----	-----	-----	-----	3.03	-----	-----
Michigan	4.13	-----	-----	(1)	-----	-----	-----	5.02	-----	-----	-----	-----	-----	-----
Minnesota	3.61	-----	-----	$3.88	(1)	-----	(1)	4.21	-----	-----	$4.51	(1)	(1)	(1)
New Jersey	-----	-----	-----	-----	-----	$8.38	-----	-----	-----	(1)	-----	-----	$9.90	-----
New York	(1)	-----	(1)	-----	-----	7.84	$8.66	(1)	-----	(1)	(1)	-----	7.70	$9.81
Pennsylvania		-----		-----	-----				-----	(1)	-----	-----	(1)	10.62
Utah	-----	-----	$1.21	-----	-----	-----	-----	-----	-----	$1.63	-----	-----	-----	-----
Other States [2]	3.61	$3.00	6.43	6.43	5.14	-----	-----	4.10	$2.47	7.03	7.59	4.38	-----	(1)
Average, all States	3.70	3.00	1.81	3.92	3.98	7.89	7.44	4.29	2.47	2.21	4.59	3.91	7.87	8.21
Byproduct ore: [3]														
Delaware														
Tennessee	-----	-----	-----	-----	-----	-----	5.91	-----	-----	-----	-----	-----	-----	7.56
Virginia														

[1] Included with average for all States.
[2] Includes California, Missouri, Nevada, Texas, Virginia, Washington, Wisconsin, and Wyoming.
[3] Cinder and sinter obtained from pyrites treated in, but not necessarily mined in, States indicated.

Prices of Lake Superior Iron Ore.—Lake Erie base prices for Lake Superior iron ores remained throughout the season at the level made effective December 30, 1948, for the 1949 season. This level specified Old Range Bessemer at \$7.60; Old Range non-Bessemer, \$7.45; Mesabi Bessemer, \$7.35; Mesabi non-Bessemer, \$7.20, and High-Phosphorus, \$7.20 per gross ton. Prices for 1950 had not been announced at the end of the year.

Lake Erie prices are used as a basis for negotiation since few ores match the specifications listed. These prices are for ore delivered at lower Lake ports, carrying 51.5 percent natural iron content with 0.045 percent (max.) phosphorus (dry), for Bessemer grades and up to 0.18 percent phosphorus, for non-Bessemer grades. Above 0.18 percent, the ores are classed as High-Phosphorus. Premiums and penalties are applied for variations in the analyses and physical structure.

[5] U. S. Department of Labor Index, All Commodities.

Freight Rates.—Upper Lake rail freight rates remained unchanged in the 1949 season at $1.05 per gross ton from Minnesota ranges to upper Lake ports, $0.92 for rail movement, and $0.13 for dock loading. Vessel rates increased $0.12 per ton during 1949, of which $0.10 was a freight-rate increase effective at the beginning of the season and $0.02 was in dock handling charges (hold to rail of the vessel, $0.018 effective January 11 and $0.0092 September 1, 1949). Vessel rates totaled $1.45 per gross ton. Lower Lake rail freight rates increased 17 cents to $1.89 per gross ton to the Pittsburgh-Wheeling area. Thus, total transportation charges from the Mesabi range to Pittsburgh were $4.39 per gross ton at the end of the 1949 season. Average value of ore before shipment from the Mesabi range was $4.24 per ton, making the indicated average value of Mesabi ore in Pittsburgh yards $8.63 per ton.

FOREIGN TRADE [6]

The following tables list the country, tonnage, and value of iron ore imported and exported during 1947–49. There were no important new sources in 1949, although the import totals were again record-high. Nearly all of the increase was supplied by Sweden and Canada, while Chile virtually equaled its 1948 shipments. Canada, however, again received more ore from the United States than it exported to the United States. Japan was the only other country receiving an important tonnage of United States iron ore.

Iron ore imported for consumption in the United States, by countries, 1947–49, in gross tons

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Algeria	30,733	$164,659	405,224	$2,066,463	415,501	$2,349,746
Argentina					20	24,809
Belgium-Luxembourg	21	498	[1] 2	[1] 88		
Brazil	85,534	421,621	295,926	1,524,539	354,509	2,355,137
British West Africa	22,970	191,718	18,528	171,199	59,548	395,034
Canada [1]	1,553,245	7,587,385	985,846	5,838,645	1,603,106	10,615,629
Chile	[2] 1,662,241	[2] 4,723,452	2,631,997	7,526,640	2,627,007	6,891,016
Cuba	153,050	773,722	34,500	101,775	11,589	24,763
Egypt					7,500	88,650
France	[1] 702	[1] 755	9,041	63,302		
French Morocco			8,690	60,830		
Iran	1,500	42,000	3,000	162,000	1,500	90,000
Italy	16	50	[1] 9,451	[1] 64,948		
Liberia			4	85	30	105
Mexico	54,966	102,633	163,149	334,447	169,823	284,557
Netherlands					7,114	64,026
Norway	28,246	165,258	108,616	634,602		
Philippines			4,160	28,880	5,250	51,816
Spain			6,449	66,825	9,200	78,658
Spanish Africa			8,500	48,875		
Sweden	1,286,896	7,756,413	1,358,962	8,317,362	2,047,343	13,029,826
Tunisia	6,000	50,100	56,358	297,748	82,815	424,076
Union of South Africa	8,932	49,455				
United Kingdom	600	43,049	351	21,229	302	22,895
Total	[2] 4,895,652	[2] 22,072,768	6,108,754	27,330,482	7,402,157	36,790,743

[1] Includes pyrites cinder.
[2] Revised figure.

[6] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Iron ore exported from the United States, by countries of destination, 1947–49, in gross tons

[U. S. Department of Commerce]

Destination	1947		1948		1949	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Argentina	1	$74				
Australia					12	$3,109
Canada	[1] 2,811,134	[1] 10,011,763	3,019,683	$13,192,918	2,168,764	12,312,318
Canal Zone	11	228			9	200
France	20	1,183				
French Morocco			99	4,951		
Japan			60,869	546,089	251,791	2,293,560
Netherlands	9	693	15	1,021	75	5,804
Norway					75	788
Philippines					4,048	36,806
United Kingdom					3	1,232
Total	[1] 2,811,175	[1] 10,013,941	3,080,666	13,744,979	2,424,777	14,653,817

[1] Revised figure.

BENEFICIATION

Each year, the percentage of iron-ore shipments that receives treatment, designed to make a more desirable blast-furnace feed, climbs higher. During the 10-year period 1930–39 the percentage fluctuated from a low of 7.6 percent in 1932 to a high of 18.8 percent in 1936, while the over-all change was from 16.3 to 17.2 percent. Since 1940 the percentage has climbed steadily to 24.5 percent in 1949. Thus, the importance of ore treatment increases, and industry is recognizing this fact by allotting larger funds to beneficiation research.

Crude iron ore is divided into three groups. The first group includes the diminishing ores suitable for direct blast-furnace feed as mined, usable with only a primary crushing operation. The second group formerly included only those ores that were made acceptable by hand picking or simply washing away loose gangue material. In recent years, however, this second group has been expanded to include ores that require beneficiation by more complex methods. These ores have their iron minerals bonded to the gangue minerals in small particles, which must be liberated by grinding before they can be separated. The relative size of the iron particles grades downward, and economic factors control the lower limit of the particle size that may be liberated. After liberation, separation is accomplished by jigs in the case of larger particles, magnetic devices when the ore is magnetite, and heavy-medium or gravity methods for the finer particles. The concentrated product must then be sintered or pelletized into a suitably large and porous blast-furnace feed. Group 3 may not yet be truly classed as an ore, since it refers to taconite, which has not yet achieved economic beneficiation. Nevertheless, industrial determination and economic necessity assure a place for taconite concentrates in the near future. Trade literature since World War II offered profuse information on taconite beneficiation, and preliminary research indicates that the iron formation bearing magnetite particles will be first to achieve economic beneficiation. Reserves of this type

of taconite are estimated to be adequate to produce 1.7 billion [7] tons of concentrates.

Iron ore shipped from mines in the United States, 1925–29 (average) and 1930–49, in gross tons, and percentage of beneficiated ore compared to total shipped

[Exclusive of ore containing 5 percent or more manganese]

Year	Benefi-ciated	Total	Proportion of beneficiated to total (percent)	Year	Benefi-ciated	Total	Proportion of beneficiated to total (percent)
1925–29 (av.)	8,653,590	66,697,126	13.0	1939	9,425,809	54,827.100	17.2
1930	8,973,888	55,201,221	16.3	1940	12,925,741	75,198,084	17.2
1931	4,676,364	28,516,032	16.4	1941	19,376,120	93,053,994	20.8
1932	407,486	5,331,201	7.6	1942	23,104,945	105,313,653	21.9
1933	3,555,892	24,624,285	14.4	1943	20,117,685	98,817,470	20.4
1934	4,145,590	25,792,606	16.1	1944	20,303,422	94,544,635	21.5
1935	6,066,601	33,426,486	18.1	1945	19,586,782	87,580,942	22.4
1936	9,658,699	51,465,648	18.8	1946	15,588,763	69,494,052	22.4
1937	12,350,136	72,347,785	17.1	1947	21,407,760	92,670,188	23.1
1938	4,836,435	26,430,910	18.3	1948	23,629,265	100,274,965	23.6
				1949	20,658,232	84,174,399	24.5

EMPLOYMENT

Preliminary employment figures for 1949 indicate a 2-percent increase over 1948 in the number of workers in iron mines and mills and a 13-percent decrease in man-hours recorded. This divergence is directly attributable to the steel strike. The average number employed is estimated at 31,100 men working 60,600,000 man-hours to produce 85,263,810 tons of usable iron and manganiferous ores, an average of 1.407 tons per man-hour. This compares with 1.462 tons per man-hour in 1948 and 1.442 tons in 1947. A 4-percent increase in the proportion of ore mined underground in 1949 partly accounts for the decrease in ore mined per man-hour. The above data and the table that follows include, in the Lake Superior district, manganiferous ore, which is considered by the trade a special grade of iron ore.

WORLD REVIEW

The accompanying table shows world production of iron ore, by countries, in recent years.

CANADA [8]

British Columbia.—A small shipment to electric furnaces at Wenatchee, Wash., marks the first iron-ore production from this Province in 50 years.[9] The ore was from magnetite deposits at Upper Quemsaim Lake, Vancouver Island. The operator was Coast Iron Co., Ltd. This company was recently organized by Privateer Mine, Ltd., and Frith-Kershaw, Ltd., and expects to operate on an export basis.[10]

Newfoundland.—The Wabana hematite ores outcropping on Bell Island, Newfoundland, are a bedded deposit capable of greatly expanded production. Certain difficulties, however, present themselves. Aside

[7] Gruner, John W., Mineralo

[9] Iron Age, vol. 163, No. 12, Mar. 24, 1949, p. 118.
[10] Canadian Mining Journal, vol. 70, No. 1, January 1949, p. 97.

Employment at iron-ore mines and beneficiating plants, quantity and tenor of ore produced, and average output per man in 1948, by districts and States [1]

District and State	Employment					Production									
	Average number of men employed	Time employed				Crude ore (gross tons)	Usable ore			Average per man (gross tons)					
		Average number of days	Total man-shifts	Man-hours			Gross tons	Iron contained		Crude ore		Usable ore			
				Average per shift	Total			Gross tons	Percent natural	Per shift	Per hour	Per shift	Per hour	Iron contained	
														Per shift	Per hour
Lake Superior: [1]															
Michigan, Wisconsin	7,579	290	2,195,219	8.00	17,552,143	14,594,690	14,594,690	7,243,536	49.63	6.648	0.832	6.648	0.832	3.300	0.413
Minnesota	11,705	280	3,275,890	8.00	26,218,586	81,021,538	69,129,099	34,320,260	49.65	24.733	3.090	21.102	2.637	10.477	1.309
Total	19,284	284	5,471,109	8.00	43,770,729	95,616,228	83,723,789	41,563,796	49.64	17.477	2.184	15.303	1.913	7.597	.950
Southeastern States: [2]															
Alabama	6,053	284	1,722,026	8.07	13,889,298	11,919,057	8,088,664	3,096,048	38.28	6.922	.858	4.697	.582	1.798	.223
Georgia	99	249	24,680	10.18	251,249	1,368,820	273,735	113,368	41.42	55.463	5.448	11.091	1.089	4.594	.451
Total	6,152	284	1,746,706	8.10	14,140,547	13,287,877	8,362,399	3,209,416	38.38	7.607	.940	4.788	.591	1.837	.227
Northeastern States:															
New Jersey	741	251	185,729	8.03	1,490,939	857,444	436,567	279,280	63.97	4.617	.575	2.351	.293	1.504	.187
New York, Pennsylvania	3,104	305	947,263	8.07	7,641,960	9,522,355	3,986,404	2,418,533	62.50; 56.00	10.052	1.246	4.208	.522	2.553	.316
Total	3,845	295	1,132,992	8.06	9,132,899	10,379,799	4,422,971	2,697,813	61.00	9.161	1.137	3.904	.484	2.381	.295
Western States:															
California, Nevada, Washington	63	172	10,806	8.00	86,453	167,993	167,993	90,762	54.03	15.546	1.943	15.546	1.943	8.399	1.050
Missouri, Texas, Wyoming	770	280	215,562	8.05	1,735,109	4,685,242	1,703,297	759,749	44.60	21.735	2.700	7.902	.982	3.525	.438
Utah	261	306	79,818	8.05	642,893	3,233,413	3,233,413	1,743,736	53.93	40.510	5.029	40.510	5.029	21.846	2.712
Total	1,094	280	306,186	8.05	2,464,455	8,086,648	5,104,703	2,594,247	50.82	26.411	3.281	16.672	2.071	8.473	1.053
Total 1948 [2]	30,375	285	8,656,993	8.03	69,508,630	127,375,445	101,616,853	50,065,272	49.27	14.714	1.833	11.738	1.462	5.783	.720

[1] Includes manganese-bearing ore from the Lake Superior district.

[2] Man-hour data for Virginia are not available and are therefore excluded from all totals; however, production data for Virginia (4,893 gross tons of crude ore and 2,991 tons of usable ore) are included with total production.

World production of iron ore, by countries, 1943–49, in metric tons[1]

(Compiled by Pauline Roberts)

Country[1]	1943	1944	1945	1946	1947	1948	1949
North America:							
Canada	581,769	501,899	1,030,052	1,405,696	1,741,210	1,213,121	3,424,174 (Canada and Newfoundland)
Newfoundland	551,515	471,824	1,000,449	1,264,141	1,466,577	1,491,618	
Cuba	47,113	28,370	----	----	63,276	36,595	11,961
Mexico	252,437	301,550	282,524	275,445	332,446	333,100	362,600
United States	102,872,863	95,628,294	89,794,834	71,980,145	94,585,639	102,624,598	86,300,693
South America:							
Argentina	150	1,921	43,353	55,400	60,500	(2)	(2)
Brazil	792,217	782,000	716,000	517,765	926,625	1,441,119	(2)
Chile[3]	299,411	674,529	944,863	1,352,886	1,607,929	2,545,401	2,597,330
Europe:							
Austria	3,188,459	3,014,909	323,189	462,016	884,856	1,269,100	1,487,616
Belgium	127,890	43,590	29,800	39,910	58,209	96,720	41,760
Czechoslovakia	1,944,000	1,584,000	276,000	1,116,074	1,363,491	1,428,000	[4] 1,400,000
France[5]	31,934,000	19,012,800	7,712,760	16,232,220	18,718,510	23,031,000	31,424,000
Germany[6]	10,763,000	[7] 10,269,000	(2)	4,140,100	[8] 4,463,000	[8] 7,276,000	9,112,000
Hungary	837,640	[9] [10] 427,660	[9] 47,800	132,970	243,940	255,240	293,000
Italy	835,773	390,438	133,951	131,617	226,254	543,241	520,842
Luxembourg	5,253,025	2,912,500	1,405,877	2,246,908	1,992,167	3,399,274	4,137,327
Norway	219,000	264,426	78,538	59,972	127,798	287,992	375,878
Poland	717,331	680,754	105,669	395,470	504,454	602,000	[11] 506,801
Rumania	252,058	243,418	140,797	111,502	120,870	[4] 140,000	[4] 200,000
Spain	1,587,817	1,508,610	1,171,377	1,596,212	1,513,911	1,630,728	1,811,112
Sweden	10,819,997	7,253,359	3,929,662	6,867,208	8,894,544	13,287,118	[4] 14,000,000
Switzerland	276,959	214,499	17,436	18,000	45,000	[4] 75,000	40,000
U. S. S. R.[12]	[4] 14,000,000	[4] 16,000,000	[4] 18,000,000	[4] 21,000,000	[4] 24,000,000	(2)	(2)
United Kingdom:							
Great Britain[13]	18,790,524	15,720,021	14,425,878	12,368,377	11,268,909	13,299,282	13,620,000
Northern Ireland	6,660	579	(2)	----	----	----	(2)
Asia:							
China	10,560,500	8,845,700	4,178,000	[14] 15,114	[14] 18,694	[4] [14] 246,600	(2)
French Indochina	80,576	21,975	7,925	----	----	----	----
India	2,697,813	2,401,576	2,300,524	2,446,325	2,538,559	2,321,255	(2)
Japan[15]	[16] 3,057,177	[16] 4,367,879	[16] 1,356,260	566,470	500,212	561,063	779,674
Korea:							
North	2,359,000 (North and South)	3,387,000	832,953	[4] 75,000	[4] 93,000	(2)	(2)
South				----	----	----	----
Malaya	49,137	10,621	13,590	205	902	651	8,525
Philippines	(2)	(2)	(2)	----	----	18,289	370,172
Portuguese India	(2)	(2)	(2)	(2)	(2)	(2)	151,000
Turkey	91,751	90,430	125,708	112,210	145,620	185,434	216,043
U. S. S. R.	(2)	(2)	(12)	(12)	(2)	(2)	(2)
Africa:							
Algeria	183,492	783,928	1,202,448	1,671,244	1,558,055	1,871,522	2,538,518
Belgian Congo	23,964	----	----	----	----	----	(2)
French Morocco	10,670	6,600	104	124,870	156,310	301,300	356,800
Northern Rhodesia	624	212	76	162	1,528	149	1,749
Sierra Leone	517,727	641,165	840,611	741,105	854,128	967,888	(2)
Southern Rhodesia	182	----	----	----	286	30,478	51,485
Spanish Morocco	547,625	690,880	764,816	787,340	869,016	904,330	943,539
Tunisia	29,703	88,863	132,450	183,705	403,691	690,200	711,894
Union of South Africa	738,128	768,392	775,470	946,828	1,162,127	1,163,723	1,248,000
Oceania:							
Australia:							
New South Wales	205,691	154,326	43,358	----	----	----	----
Queensland	3,095	2,375	1,743	1,681	1,364	2,156	(2)
South Australia	2,217,865	2,061,810	1,543,983	1,847,398	2,179,965	2,067,485	[11] 762,917
Western Australia	86	----	----	----	----	7,338	[11] 9,277
New Caledonia	36,280	60,406	----	----	(2)	(2)	(2)
New Zealand	5,068	6,133	6,164	7,525	6,326	4,853	(2)
Total (estimate)	231,000,000	203,000,000	162,000,000	153,500,000	186,000,000	216,000,000	218,000,000

[1] In addition to countries listed, Bulgaria, Burma, Egypt, Eritrea, French West Africa, Greece, Madagascar, Portugal, South-West Africa, and Yugoslavia report production of iron ore in past years, but quantity produced is believed insufficient to affect estimate of world total, except for Yugoslavia for which estimate has been included in the total.
[2] Data not available; estimate by author of chapter included in total.
[3] Production of Tofo mines.
[4] Estimate.
[5] Including Moselle (Lorraine).
[6] Exclusive of manganiferous iron ore carrying 12 to 30 percent manganese.
[7] Includes Eastern Upper Silesia.
[8] Excluding Soviet zone.
[9] Data represent Trianon Hungary after October 1944.
[10] January to June, inclusive. [11] January to September, inclusive.
[12] U. S. S. R. in Asia included with U. S. S. R. in Europe.
[13] Exclusive of bog ore, which is used mainly for purification of gas.
[14] Production of National Resources Commission only.
[15] Includes iron sand production as follows: 1943–44, 427,000 tons; 1944–45, 858,782 tons; 1945–46, 235,094 tons; 1946, 10,472 tons; 1947, 3,772 tons; 1948, 2,583 tons; 1949, 23,724 tons.
[16] Fiscal year ended Mar. 31 of year following that stated.

from the fact that workings extend over 2 miles under Conception Bay, the ore is high in phosphorus and does not lend itself to large use in United States furnaces (a small tonnage was consumed in the blast furnace at Everett, Mass., in 1949).

Of the 1,480,000 gross tons shipped in 1949, 50 percent went to furnaces at Sydney, Nova Scotia, 48 percent to the United Kingdom, and 2 percent to the United States. Operations of Wabana mines were described in some detail.[11]

Ontario.—Shipments from Steep Rock Mines in 1949 were 1,134,261 gross tons compared with 686,385 tons in 1948, an increase of 65 percent. All output was from the Errington mine (formerly called "B" pit) and was classified into 1,096,763 tons standard grade and 37,498 tons of high-sulfur ore suitable for sintering-plant consumption. The standard ore is divided further into Seine River grade for blast furnaces and Steep Rock open-hearth lump grade.

The Errington deposit is now known to be 3,000 feet long, and the ore body has been drilled to a depth of 4,000 feet. Although several more years of surface operations are expected, the company has announced intentions to begin underground operations in 1950. Plans call for a vertical shaft to be sunk an initial depth of 1,200 feet, 2,000 feet from the open pit. From this shaft, three levels beneath the open pit will be developed. The lower level will be used for pumping until subsequent lower levels take over this operation, leaving the higher levels for mining. The objective of the underground plan is to attain a production of 1,000,000 tons annually by 1955, when the open pit will be inoperable.

Production from the Hogarth mine ("A" ore body) is expected to begin in 1953. Financial arrangements have been completed, and a contract let for the stripping of lake silt. Full production is not expected until 1955.

The "C" ore body has been leased to the Inland Steel Co., and development work begun. The geology of the Steep Rock lake area was described in 1949.[12]

Siderite deposits in the Michipicoten district are high grade, and reserves are extensive. However, the only producer in 1949 was the Helen mine, operated by Algoma Ore Properties, Ltd., a subsidiary of Algoma Steel Corp., Ltd. The product is calcined and sintered before blending with Lake Superior hematites. Mine shipments in 1949 were 662,000 tons of sinter, although the plant has a capacity of 1,000,000 tons per year.

Additional crude-ore production is expected in 1950 from the Victoria open pit and an underground operation on the same ore body. Development continues on the Siderite Hill deposit, discovered late in 1948, and it is reported that this property will permit surface mining.

The Ruth and Lucy properties are under lease to Jones & Laughlin Steel Corp., but development work has not yet begun.

A recent review[13] points out the geologic similarity of Eastern Ontario to the magnetite-producing areas of the Adirondacks in New

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[11] Gilliatt, J. B., Iron-Ore Mines of Wabana, Newfoundland: Skillings' Mining Review, vol. 38, No. 3, Apr. 30, 1949, pp. 1–4, 5, 15.
[12] Hicks, W. S., Geology of the Iron Deposits of Steep Rock Iron Mines, Ltd.: The PreCambrian, vol. 23, No. 5, May 1950, pp. 8–13.
[13] Bonham, W. M., Magnetite in Eastern Ontario: Canadian Min. Jour., vol. 70, No. 8, August 1949, pp. 57–60.

York. Evidence is presented to show the possibility of producing magnetite concentrates on a scale comparable to that of New York.

Quebec.—Noranda Mines, Ltd., continued research and development on the extensive reserves of pyritic iron ore in Quebec.

Quebec-Labrador.—Progress in the development of the northern hematite deposits was highlighted by the announcement that plans had been completed for constructing the railroad from Seven Islands to the deposit, a distance of 350 miles. Proved reserves at the end of 1949 were 358,000,000 tons, of which 205,000,000 were Bessemer grade, 109,000,000 were non-Bessemer, and 44,000,000 manganiferous (7.87 percent Mn). Due to the large sums involved, financial arrangements are complex. Hollinger-Hanna, Ltd., is the central company, with various combines organized to aid in bringing deposits into production. The Iron Ore Co. of Canada, Ltd., is composed of six United States companies, and its duties include financing to the point of production and then marketing the ore. Mining operations will be conducted by the central company, Hollinger-Hanna, Ltd., while continued exploration will be done by either or both subsidiary companies, Labrador Mining & Exploration Co., Ltd., and Hollinger North Shore Exploration Co. Other subsidiary companies include: Hollinger Ungava Transport, Ltd.; Ungava Power Co., Ltd.; and Quebec North Shore & Labrador Railway Co., Ltd.[14]

Reports emphasize that proved reserve tonnages do not indicate the ultimate extent of the ore that will be available. Only enough reserves have been proved to justify the necessarily large capital outlay. At this point, there is no doubt that enough high-grade ore is available to permit surface operations for many years. The principal difficulty remaining to be overcome is the problem of transportation low enough in cost to permit economic production of 10,000,000 tons annually. This figure is judged to be the minimum that will support economic operations.

OTHER COUNTRIES

Argentina.—Exploration has begun of the iron-ore deposits near Sierra Grande between Antonio Oeste and Puerto Madryn in the Territory of Rio Negro, Argentina. The deposits are conveniently located only 22 miles from the coast and are said to be both extensive and rich.[15]

Australia.—Government agencies are making a broad survey for new Australian mineral deposits, including iron ore and its supporting raw minerals. Modern geophysical methods are being used.[16]

Austria.—The Oesterreich-Alpine Montangesellschaft, an iron-mining company producing Styrian ore concentrates, has, with the assistance of the Economic Cooperation Administration, incorporated modern beneficiation practices at its Erzberg mine. Production does not yet meet domestic ore requirements, but substantial increases were made in 1949.[17] The ore is low grade, running only

[14] Rice, H. R., Grand-Scale Prospecting in Labrador and Quebec: Canadian Min. Jour., vol. 70, No. 9, September 1949, pp. 65-77.
[15] Chemical Age (London), vol. 61, No. 1571, Aug. 20, 1949, p. 265.
[16] Metal Bulletin (London), No. 3373, Mar. 8, 1949, p. 8.
[17] Mining World, vol. 11, No. 7, June 1949, p. 60.

about 25 percent iron as mined. However, it is manganiferous and easily beneficiated.[18]

Ceylon.—Iron ore of lateritic origin is available from deposits that have been mined in the past on the island of Ceylon. Plans have been announced to build a small-scale iron furnace to supply local needs.[19]

Chile.—An agreement signed recently by Bethlehem Chile Iron Mines and Cia de Acero del Pacifico calls [20] for Bethlehem to supply iron ore to Pacifico's furnaces at Corral for 20 years. Included also are plans for exploiting the El Romeral deposit near La Serena.

Cuba.—The Mayari Deposit was the only Cuban iron ore producer in 1949.

Iron ore shipped from mines in the Province of Oriente, Cuba, 1884–1949, in gross tons

Year	Juragua, Daiquiri, and Estancia (hematite and magnetite)	Sigua (hematite)	Mayari (brown ore)	Guama (hematite)	El Cuero (hematite)	Total
1884–1947	22,740,281	20,438	4,045,133	41,241	903,103	27,750,196
1948			34,025			34,025
1949			11,446			11,446
Total	22,740,281	20,438	4,090,604	41,241	903,103	27,795,667

Czechoslovakia.—The Medlov and Sternberg iron mines in Czechoslovakia plan [21] to increase capacity to offset the loss of imports from Yugoslavia. An iron-ore shortage in this country is partly responsible for the poor showing of the 2-year plan to increase steel output.

Dominican Republic.—Rich iron deposits reported [22] to contain 43 million tons of 67 percent iron have been discovered in the Duarte Province of the Dominican Republic. As in many other small countries, hope is entertained that a small domestic steel industry may be established on the strength of domestic mineral resources.

Egypt.—The Mines and Quarries Administration of the Egyptian Government reports [23] discovery of an iron-ore deposit near the El Quseir (formerly Kosseir) region and another at Wadi Karim, west of El Quseir. The deposits are only about 18 miles from the Red Sea.

Finland.—While Finland's iron-ore requirements are being met [24] by imports, principally from Sweden, efforts are being made to develop an important deposit of titaniferous magnetite near Lake Oulujärvi in the central part of the country. The mine is owned and operated on a pilot-plant scale by the Finnish Government.

France.—The French Iron Ore Mines Federation reports [25] that the mere addition of manpower will not increase production from iron mines in the Lorraine Basin. Consequently, rising costs are to be met by plans for increased mechanization. It is believed that the technical advantages obtained will permit easier labor relations as

[18] Steel magazine, vol. 126, No. 6, Feb. 6, 1950, pp. 102–104.
[19] Chemical Age (London), vol. 60, No. 1551, Apr. 2, 1949, p. 492.
[20] Mining World, vol. 11, No. 8, July 1949, p. 48.
[21] Mining World, vol. 11, No. 9, August 1949, p. 49.
[22] Steel magazine, vol. 124, No. 24, June 13, 1949, p. 53.
[23] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 1, January 1950, p. 14.
[24] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 6, December 1949, pp. 8–9.
[25] Iron Age, vol. 164, No. 10, Sept. 8, 1949, pp. 30, 170.

well as increased production owing to the provision of more desirable jobs for the workers.

Liberia.—One of the outstanding developments in the iron-ore industry during 1949 was announced by the Republic Steel Co. in March.[26] Republic has bought an interest in the Liberian Mining Co., Ltd., which was organized by L. K. Christie to develop the Bomi Hills iron ore deposit. Company engineers and geologists from the United States Geological Survey proved that iron deposits in the highlands of the northeastern part of the country contained enough high-grade ore to warrant exploitation. Additional financial aid was obtained from the Export-Import Bank of Washington, D. C., in May 1949.[27]

Reserves are estimated at over 20 million tons of open-hearth-grade ore with additional tonnages of blast-furnace grade.[28] The deposit selected for exploitation is at Bomi Hills, 45 miles northeast of the modern port and capital, Monrovia. Open-pit operations will start on an ore face outcropping 150 feet high and half a mile long, and a railway is under construction between the port and the deposit. Republic has first option on the product, with surplus to be sold on the world market. Initial production will approximate 1,000,000 tons per year.

Malaya.—Exports from mines in Malaya have been small in recent years. However, large reserves of high-grade iron ore exist, and the Japanese market promises to aid in developing these deposits. Plans call for export of 600,000 tons from the Bukit Besi mine as soon as shipping is available for transport to Japan.[29]

New Zealand.—Experimental production of pig iron from the titaniferous sands distributed widely along the west beaches of New Zealand was achieved in 1949.[31] The sands contain, in addition to iron, recoverable amounts of titanium and vanadium. Electric furnaces have proved most successful metallurgically for separating these elements, but at present little encouragement can be found for electricity as a source of power.

Norway.—The Sydvaranger iron mines in northeastern Norway are scheduled [30] to be reactivated under a project approved by the Economic Cooperation Administration. These mines were in operation from 1910 until they were destroyed by the German Army in 1944. This product is a high-grade magnetite concentrate, in great demand for mixing with Europe's low-grade ores. Highest production was 1,340,408 metric tons of concentrates in 1939.

Sierra Leone.—Exports of high-grade ore from the Marampa iron mines in Sierra Leone to Great Britain approached a million tons in 1948,[32] and expansion plans were being given serious consideration. The undeveloped deposits in the Tonkolili area have proved reserves of [33] 100 million tons containing 55–60 percent iron with low sulfur and silica. Both the Marampa and Tonkolili deposits are owned by the Sierra Leone Development Co., Ltd.

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[26] Steel magazine, vol. 124, No. 12, Mar. 21, 1949, p. 66.
[27] American Metal Market, vol. 56, No. 89, May 7, 1949, p. 1.
[28] Iron Age, vol. 163, No. 8, Feb. 24, 1949, p. 143.
[29] Mining Journal (London), vol. 233, No. 5948, Aug. 20, 1949, p. 767.
[30] Skillings' Mining Review, vol. 38, No. 28, Oct. 28, 1949, p. 16.
[31] Mining Journal (London), vol. 234, No. 5970, January 1950, p. 58.
[32] Foreign Commerce Weekly, vol. 36, No. 11. Sept. 12, 1949, p. 26.
[33] Metal Bulletin (London), No. 3415, Aug. 12, 1949, p. 11.

Southern Rhodesia.—Reserves of domestic iron ore have been proved adequate for the needs of the furnaces built in 1948 for the Rhodesian Iron and Steel Commission.[34]

Sweden.—The Geological Inspection Department of Sweden stated in a report [35] to the Government, that as known iron-ore fields are capable of providing all the ore that can be transported or marketed in present circumstances, it was unreasonable to expect the Government to bear the expense of further exploration. Thus, Sweden presents the unusual case of a restricted rather than expanded search for mineral resources.

Turkey.—The Divrigi iron mine, which supplies the Karabuk Iron & Steel Works in Turkey, will increase output to enable the two blast furnaces to operate at capacity. It is planned to divert coke from other industries if necessary to obtain additional pig iron.[36]

Union of South Africa.—Undeveloped reserves in the Union have been estimated [37] at over 6 billion tons containing over 40 percent iron. Of these reserves 120 million tons are high-grade hematite containing over 60 percent iron.

United Kingdom.—Recent reviews describe British beneficiation and blending practices which allow use of domestic low-grade ores.[38] [39]

Venezuela.—Publication of the results of explorations by American firms in Venezuela revealed the importance that country will assume in the future iron-ore supply pattern of the United States.[40] The concessions of the U. S. Steel Corp. include a number of known deposits distributed over a wide area, but one deposit overshadowed all others and is the one selected for initial exploitation. This deposit, now known as Cerro Bolivar, contains over half a billion tons of high-grade ore. Cerro Bolivar is a small mountain 50 miles due south of Ciudad Bolivar. It rises 2,000 feet above the surrounding savanna country and is about 11 miles long. The area covered by drilling was 18,000 feet by 1,200 feet, with holes usually bottomed in quartzite at an average ore depth of 148 feet. Samples of ore contained 10 percent moisture, indicating an average natural iron content of 56.7 percent.

The biggest problem remaining to be overcome is transportation. A choice must be made between utilizing the Orinoco River and building a railroad across country 274 miles to a tidewater terminal near Barcelona. If the river is decided upon, a railway must be built between Cerro Bolivar and the confluence of the Orinoco and Caroni Rivers, a distance of 91 miles; from there a channel must be dredged deep enough for the largest oceangoing ore carriers or barges for transferring ore to ocean vessels at tidewater. Eventually, the corporation expects to ship over 13 million tons annually. Distance to United States consuming centers are of particular interest. From Cerro Bolivar to Orinoco River port, 91 miles; thence to tidewater, 170 miles; mouth of the Macareo River (central Orinoco delta branch)

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[34] Metal Bulletin (London), No. 3377, Mar. 22, 1949, p. 11.
[35] Mining World, vol. 11, No. 5, May 1949, p. 52.
[36] Mining World, vol. 11, No. 3, March 1949, p. 30.
[37] Metal Bulletin (London), No. 3414, Aug. 9, 1949, pp. 7–8.
[38] Howat, David D., Britain Gets Half Its Iron from Its Lean Ores: Eng. and Min. Jour., vol. 150, No. 6, June 1949, pp. 66–69.
[39] Howat, David D., Britain's Iron Mines Also Have Their Problems: Eng. and Min. Jour., vol. 150, No. 6, May 1949, pp. 74–77.
[40] Journal of Metals, vol. 188, No. 2, February 1950, pp. 222–236.

to Baltimore, 2,280 miles; to Mobile, 2,460 miles; Mobile to Birmingham, 276 miles (rail) and 280 miles (water); Barcelona to Mobile or Baltimore, 2,190 miles.

The Bethlehem Steel Corp. has developed the El Pao deposit to the point of production. Shipments had been expected in 1949; but difficulties at the ocean terminal, Puerto Hierro, had not been cleared by year's end. Shipments by way of Bethlehem's facilities are expected ultimately to reach 3 million tons annually. These facilities were described.[41]

[41] Business Week, vol. 1033, June 18, 1949, pp. 121-124.

Iron and Steel

By Norwood B. Melcher

GENERAL SUMMARY

THE domestic steel industry of 1949 suffered severe production set-backs resulting from numerous work stoppages at coal mines and one of the most costly steel strikes in the Nation's history. In the second and third quarters, production also declined from a general business recession attributed in large part to cautious buying policies by the major steel-consuming industries. This recession, which affected many industries other than steel, was due only in part to lower consumer purchasing; consequently a substantial portion of sales was made from inventories, whereas in 1948 production went both to consumers and to building up inventories. As a result of these factors, the rate of steel production declined from 94.1 percent of capacity in 1948 to 81.1 percent in 1949. The production of steel ingots and castings declined 12 percent, and pig iron dropped 11 percent during the year.

The steel strike of 1949 was called at 12:01 a. m. October 1, and steel production immediately dropped to the lowest operating rate (percentage of capacity) in history and the lowest tonnage output since July 1932. Operations were limited to production of a few relatively small independent companies and averaged only 11.2 percent of capacity. On October 31 the Bethlehem Steel Co. signed agreements with the United States Workers providing for a company-financed pension program and company-employee social security insurance benefits effective January 1, 1950; other large companies signed similar agreements on November 8, followed by a settlement with the United States Steel Corp. November 11. By the time furnaces were back in full production, virtually 6 weeks had elapsed, and 10,000,000 tons of steel ingots were lost from the 1949 output. Steel production recovered quickly, however; a major backlog of steel orders had accumulated during the strike, and it was evident that steel would be produced at a high rate in the early months of 1950.

Of the major steel-consuming industries, the automotive industry was an outstanding exception to a lower steel use pattern in 1949 as compared with the previous year. That industry established all-time records in production during 1949 in producing 5,114,269 passenger cars and 1,123,792 trucks. In this record production the industry received 11 million tons of steel products or 19 percent of the shipments to all consuming industries. The high demand for automobiles continued throughout the year in spite of the general slackening in consumer demand for most products. Dealers were still unable to accumulate inventories of most models, even at the close of 1949, and prospects forecast even greater production and consequent higher steel requirements in 1950.

Salient statistics of iron and steel in the United States, 1945–49, in net tons

	1945	1946	1947	1948	1949
Pig iron:					
Production	53,224,213	44,842,025	58,327,231	60,073,140	53,323,142
Shipments	53,265,353	45,075,890	58,367,510	60,051,350	52,919,019
Imports	21,433	14,091	32,624	[1] 222,333	99,804
Exports	90,833	95,698	40,202	7,032	81,309
Steel: [2]					
Production of ingots and castings:					
Open-hearth:					
Basic	71,069,876	60,112,300	76,209,268	78,714,852	69,742,110
Acid	869,726	599,663	664,525	625,305	506,693
Bessemer	4,305,318	3,327,737	4,232,543	4,243,172	3,946,656
Crucible	24	} 2,563,024	18	} 5,057,141	3,782,717
Electric	3,456,704		3,787,717		
Total	79,701,648	66,602,724	84,894,071	88,640,470	77,978,176
Capacity, annual	95,505,280	91,890,560	91,241,250	94,233,460	96,120,930
Percent of capacity	83.5	72.5	93.0	94.1	81.1
Production of alloy steel:					
Stainless	542,904	550,097	519,933	617,378	447,025
Other than stainless	8,104,807	5,527,098	6,908,298	7,863,736	5,450,544
Total	8,647,711	6,077,195	7,428,231	8,481,114	5,897,569
Shipments of steel products:					
For domestic consumption	53,448,897	45,763,761	58,850,458	62,728,250	54,586,039
For export	3,793,343	3,011,771	4,206,692	3,244,888	3,517,971
Total	57,242,240	48,775,532	63,057,150	65,973,138	58,104,010

[1] Revised figure.
[2] American Iron and Steel Institute. Capacity figures Dec. 31 from A. I. S. I. Form 7.

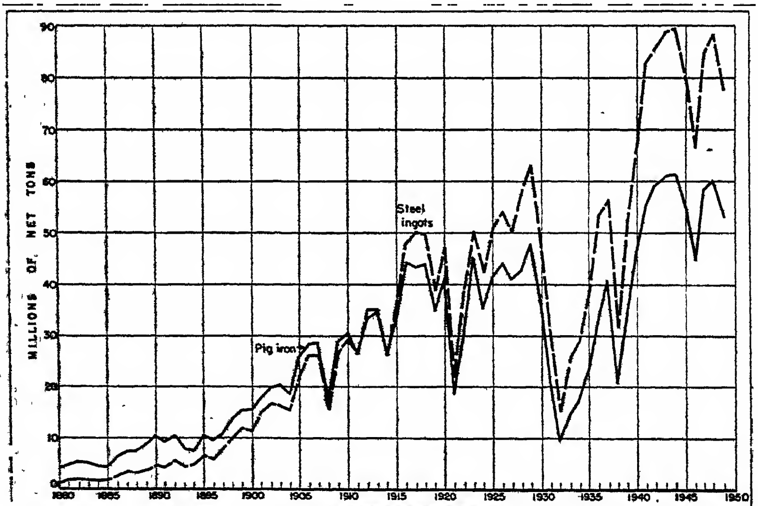

FIGURE 1.—Trends in production of pig iron and steel ingots in the United States, 1880–1949.

According to Steel magazine, steel-plant expenditures totaled 627 million dollars in 1949 compared with 583 million dollars in 1948 and 496 million in 1947. The construction industry (including contractors' products, such as plumbing and heating equipment) in 1949 obtained a slightly larger proportion of total steel than in 1948, although the tonnage received was 2 percent less. Construction of

dwelling units was high in 1949, with 1,023,000 units started during the year. Total new construction during the year was valued at 19.3 billion dollars compared with 17.7 billion in 1948. Of this total, 14.1 billion was private construction. Residential accounted for one-half of the total private building. The container industry required less steel in 1949, but the market for metal containers continued strong throughout the year. New products were being packaged in cans owing partly to the transportation advantages of metal containers. Electrolytic tin-plate production continued to increase in 1949 and is reported to have exceeded the production of hot-dipped tin and terneplate for the first time.[1] The withdrawal of most Government restrictions on the use of tin plate December 1, 1949, may result in a larger use of hot-dipped plate in 1950.

Railroads received 6 percent of the steel products in 1949 compared with 8 percent in 1948, and a still lower level of steel purchasing by this industry in 1950 was anticipated. An increasing trend in the use of truck transportation for steel products may result in lower requirements for railroad cars for this service. Freight-car loadings in 1949 were reduced substantially in the second quarter and reached a low of 2,399,000 in October. Shipbuilding requirements increased slightly over 1948 but still used only slightly more than 1 percent of total steel products in 1949. Steel products for export also increased slightly from 1948, with pipes and tubes showing the largest increases, according to the U. S. Department of Commerce. In the semimanufactures, plate and sheets were the largest tonnage items and those that showed the greatest increase over the previous year.

The steel industry continued to operate on a 40-hour-a-week basis during 1949, although the average weekly hours per worker was only 37.9, resulting from a low average during the strike months of October and November. Average weekly wages decreased during the year from $66.24 in January to $64.56 in December. Total employment declined from 550,000 in January to 505,000 at the end of the year. The composite price of finished steel as published by Iron Age dropped for five consecutive months from 3.720 cents to 3.705 cents in June and continued at this rate until December, when price increases resulted in an all-time high of 3.756 cents.

PRODUCTION AND SHIPMENTS OF PIG IRON

Domestic production of pig iron, exclusive of ferro-alloys, decreased 11 percent from 1948 and was the lowest since 1946. Pennsylvania and Ohio, the first- and second-largest States in pig-iron production, produced proportionately less pig iron than in any previous year. Pennsylvania produced 28 percent of the total in 1949, and Ohio produced 20 percent as compared to 30 and 21 percent, respectively, in 1948, proportions that had prevailed for four consecutive years. Of the pig iron manufactured in 1949, 2,260,000 tons valued at approximately $95,000,000 were made from 4,447,322 tons of foreign iron and manganiferous ores from Algeria, Brazil, Canada, Chile, Cuba, India, Mexico, Sweden, and Union of South Africa. Domestic ore (78,334,130 tons) and sinter (14,267,073 tons)

[1] Steel, vol. 126, No. 1, Jan. 2, 1950, p. 105.

and 7,865,225 tons of miscellaneous materials were reported used in manufacturing 51,063,142 tons of pig iron. In addition to these raw materials, 1,491,501 tons of home scrap and 171,223 tons of flue dust were consumed in making pig iron in 1949.

Pig iron produced and shipped in the United States, 1948–49, by States

State	Produced		Shipped from furnaces			
	1948 (net tons)	1949 (net tons)	1948		1949	
			Net tons	Value	Net tons	Value
Alabama	4,013,771	3,662,801	3,980,677	$145,358,582	3,664,801	$131,162,133
California	361,659	504,581	375,113		494,300	
Colorado				121,033,803		103,312,763
Texas	2,528,516	2,068,917	2,530,372		2,003,329	
Utah						
Illinois	5,512,781	4,912,810	5,503,437	196,586,808	4,904,281	204,467,609
Indiana	6,493,268	6,014,258	6,496,421	245,945,553	6,028,173	248,700,000
Kentucky	799,287	627,435	799,287	(1)	627,435	(1)
Maryland	2,808,411	2,929,142	2,805,936	(1)	2,931,596	(1)
Massachusetts	140,830	168,061	140,575	(1)	125,422	(1)
Michigan	1,541,933	1,534,756	1,534,911	(1)	1,542,206	(1)
Minnesota	562,810	467,230	557,252	(1)	455,378	(1)
New York	3,734,321	3,373,409	3,744,341	122,440,520	3,243,800	142,107,633
Ohio	12,367,958	10,567,321	12,367,227	469,653,906	10,524,132	430,627,906
Pennsylvania	17,742,022	15,007,287	17,750,295	651,136,537	14,893,515	641,033,455
Tennessee	1,465,573	1,485,134				
West Virginia			1,465,506	(1)	1,480,651	(1)
Virginia	----------	----------				
Undistributed [1]	----------	----------	----------	279,966,128	----------	323,882,858
Total	60,973,140	53,323,142	60,051,350	2,232,121,837	52,919,019	2,225,294,357

[1] Data that may not be shown separately are combined as "Undistributed."

Shipments of pig iron decreased 12 percent in quantity but less than 1 percent in value from 1948. The values given in the accompanying table represent the approximate amounts received for the pig iron, f. o. b. furnaces, and do not include freight costs, selling commissions, and other items normally included in market prices for pig iron as published by trade journals.

Pig iron shipped from blast furnaces in the United States, 1948–49, by grades

Grade	1948			1949		
	Net tons	Value		Net tons	Value	
		Total	Average		Total	Average
Foundry	2,759,989	$110,686,035	$40.10	2,329,408	$91,817,177	$39.42
Basic	47,067,134	1,742,756,234	37.03	41,434,250	1,739,650,516	41.99
Bessemer	7,105,015	268,311,270	37.76	6,459,006	280,109,520	43.37
Low-phosphorus	389,119	17,250,121	44.33	221,847	10,190,651	45.94
Malleable	2,598,494	87,492,509	33.77	2,332,940	97,392,445	41.75
All other (not ferro-alloys)	139,599	5,625,668	40.30	141,568	6,134,048	43.33
Total	60,051,350	2,232,121,837	37.17	52,919,019	2,225,294,357	42.05

Metalliferous Materials Used.—The production of pig iron in 1949 required 97,048,525 short tons of iron ore, sinter, and manganiferous iron ore, 2,981,178 tons of mill cinder and roll scale, 3,353,665 tons of open-hearth and Bessemer slags, 1,502,504 tons of purchased scrap, and

27,655 tons of other miscellaneous materials—an average of 1.968 tons of metalliferous materials (exclusive of home scrap and flue dust) per ton of pig iron made.

Alabama furnaces used red hematite from the Birmingham district and brown ores from Alabama and Georgia, as well as hematite from Missouri and the Lake Superior region. Pyrites cinder was shipped from Virginia and sintered with Alabama red ores, and cinder and byproduct ore were obtained from Tennessee. Foreign iron ore from Brazil and Sweden, foreign manganese-bearing ores from Africa, Chile, India, and Mexico, and a small quantity of domestic material were also used.

Blast furnaces at Fontana, Calif., used iron ore from the Eagle Mountain and Vulcan mines in California and from the Excelsior mine in Utah. The small quantity of manganese ore used originated in Mexico.

The iron ore consumed in furnaces at Pueblo, Colo., originated from the Duncan and Blowout mines, Iron County, Utah, and the Sunrise mine, Platte County, Wyo. Manganiferous iron ore from the Boston Hill mine, Grant County, N. Mex., was also used.

The blast furnaces at Sparrows Point, Md., used various domestic iron ores and foreign iron ore from Africa, Brazil, Chile, Cuba, and Sweden; the foreign manganiferous ores used there were imported from Algeria and the Union of South Africa. The bulk of the manganiferous material used was mined domestically on the Cuyuna range in Minnesota.

Blast furnaces (including ferro-alloy blast furnaces) in the United States, 1948–49

[American Iron and Steel Institute]

State	Dec. 31, 1948			Dec. 31, 1949		
	In blast	Out of blast	Total	In blast	Out of blast	Total
Alabama	19	1	20	19	1	20
California	1		1	2		2
Colorado	4		4	3	1	4
Illinois	21	1	22	19	3	22
Indiana	20	2	22	19	3	22
Kentucky	3		3	3		3
Maryland	8		8	8		8
Massachusetts	1		1	1		1
Michigan	6		6	6		6
Minnesota	3		3	3		3
New York	16		16	15	1	16
Ohio	49		49	45	5	50
Pennsylvania	72	4	76	63	12	75
Tennessee	2	1	3	2	1	3
Texas	2		2	2		2
Utah	5		5	3	2	5
Virginia	1		1	1		1
West Virginia	4		4	4		4
Total	237	9	246	218	29	247

Blast furnaces in Illinois, Kentucky, Michigan, and Minnesota used Lake Superior iron ore and manganiferous ore exclusively. Indiana furnaces used all Lake Superior iron ore and a small quantity of manganese ore from the Union of South Africa. West Virginia furnaces used Lake Superior iron ore from mines in Canada and the United States.

Iron ore and other metallic materials consumed and pig iron produced, 1948–49, by States, in net tons

State	Metalliferous materials consumed: Iron and manganiferous iron ores: Domestic	Foreign	Sinter	Miscellaneous [1]	Total	Pig iron produced	Materials consumed per ton of pig iron made: Ores	Sinter	Miscellaneous	Total
1948										
Alabama	7,568,582	82,414	2,004,080	172,442	9,827,518	4,013,771	1.906	0.499	0.043	2.448
California	280,776	2,912	285,267	70,546	639,501	361,659	.784	.789	.195	1.768
Colorado, Texas, Utah	3,347,664	159,354	1,133,268	111,045	4,751,331	2,528,516	1.387	.448	.044	1.879
Illinois	9,560,354	------	844,203	767,893	11,172,450	5,512,781	1.734	.153	.140	2.027
Indiana	11,660,971	------	864,473	791,854	13,317,298	6,493,268	1.796	.133	.122	2.051
Kentucky	1,352,559	------	53,880	167,079	1,573,518	799,287	1.692	.068	.209	1.969
Maryland	704,638	3,496,308	322,994	471,402	4,995,342	2,808,411	1.496	.115	.168	1.779
Massachusetts	168,500	68,270	------	17,561	254,331	140,830	1.681	------	.125	1.806
Michigan	2,303,353	------	445,410	105,854	2,854,617	1,541,933	1.494	.289	.068	1.851
Minnesota	1,063,863	------	------	69,819	1,133,682	562,810	1.890	------	.124	2.014
New York	5,586,899	26,711	1,204,235	503,068	7,320,913	3,734,321	1.503	.322	.135	1.960
Ohio	17,369,591	361,566	4,265,497	1,925,878	23,922,532	12,367,958	1.433	.345	.156	1.934
Pennsylvania	25,535,084	348,557	4,591,749	3,239,872	33,715,262	17,742,022	1.459	.259	.182	1.900
Tennessee, West Virginia	2,181,760	88,324	124,920	158,278	2,553,282	1,465,573	1.549	.085	.108	1.742
Total	88,684,594	4,634,416	16,139,976	8,572,591	118,031,577	60,073,140	1.553	.269	.143	1.965
1949										
Alabama	7,026,325	10,725	1,660,100	160,890	8,858,040	3,662,801	1.921	0.453	0.044	2.418
California	447,021	756	346,488	95,635	889,900	504,581	.887	.687	.190	1.764
Colorado, Texas, Utah	2,766,796	167,428	833,853	104,198	3,872,275	2,068,917	1.418	.403	.050	1.871
Illinois	8,443,492	------	749,537	694,010	9,887,039	4,912,810	1.719	.153	.141	2.013
Indiana	10,671,520	206	764,742	678,980	12,115,448	6,014,258	1.774	.127	.113	2.014
Kentucky	985,590	------	67,614	155,855	1,209,059	627,435	1.571	.108	.248	1.927
Maryland	1,119,797	3,422,524	351,050	529,708	5,423,079	2,929,142	1.550	.120	.181	1.851
Massachusetts	227,053	65,390	------	12,893	305,336	168,061	1.740	------	.077	1.817
Michigan	2,377,331	------	366,507	114,492	2,858,330	1,534,756	1.549	.239	.074	1.862
Minnesota	923,337	------	------	62,193	985,530	467,230	1.976	------	.133	2.109
New York	4,941,348	24,988	1,099,997	533,817	6,600,150	3,373,409	1.472	.326	.158	1.956
Ohio	14,757,305	318,470	3,469,944	1,698,851	20,244,570	10,567,321	1.427	.328	.161	1.916
Pennsylvania	21,422,585	283,889	4,438,456	2,880,487	29,025,417	15,007,287	1.446	.296	.192	1.934
Tennessee, West Virginia	2,224,630	152,946	118,785	143,216	2,639,577	1,485,134	1.601	.080	.096	1.777
Total	78,334,130	4,447,322	14,267,073	7,865,225	104,913,750	53,323,142	1.552	.268	.148	1.968

[1] Excludes recycled materials.

The Everett, Mass., blast furnace used iron ores from Algeria, Newfoundland, and Sweden, as well as from the Lake Superior region. In New York, the blast furnaces in the Buffalo district used magnetite from the Mineville district in New York and hematite from Canadian and domestic mines in the Lake Superior region, as well as manganiferous ores from Minnesota. The Troy furnace consumed magnetite from the Chateaugay mine at Lyon Mountain, N. Y., and manganese ore from South Africa.

Ohio blast furnaces consumed magnetite sinter from New York, hematite from Canada, and iron and manganiferous ores from mines in the Lake Superior district.

Western Pennsylvania furnaces obtained the bulk of their iron ore from the Lake Superior district. Furnaces in the eastern part of the State used some Lake Superior ore and some magnetite ore from New Jersey, New York, and Pennsylvania. Eastern Pennsylvania furnaces also used iron ore from Africa and Sweden, while the western furnaces used foreign ores from Canada only; small quantities of pyrites cinder (both domestic and foreign) were used at eastern Pennsylvania furnaces.

Texas blast furnaces used brown iron ore from eastern Texas, as well as a considerable tonnage from Mexico; manganese ore from Mexico was also used.

Utah furnaces used semialtered magnetite from the Iron Mountain mine in Iron County, Utah, and manganiferous ores from Nevada and Utah.

Foreign iron and manganiferous iron ore consumed in the manufacture of pig iron in the United States, 1948–49, by sources of ore, in net tons

Source	1948	1949	Source	1948	1949
Africa	342,354	344,685	India	323	1,638
Brazil	49,870	6,910	Israel-Jordan	10,376	
Canada	484,839	496,395	Mexico	162,318	168,190
Newfoundland		9,566	Sweden	904,215	449,730
Chile	2,677,610	2,936,599	Unclassified	665	32,513
Cuba	1,846	1,186			
			Total	4,634,416	4,447,322

PRODUCTION OF STEEL

Steel production decreased 12 percent in 1949 from 1948, but steel capacity continued to increase. Capacity at the end of 1949, as published by the American Iron and Steel Institute, totaled 96,120,930 short tons; this figure, however, had been carried throughout 1949 and in January 1950 was revised to include new additions to capacity and totaled 99,400,000 tons. Of the total tonnage of steel ingots and castings produced in the United States in 1949, 90 percent was made in open-hearth furnaces compared with 89 percent in 1948; 5 percent was made in Bessemer converters, as during the previous year, and 5 percent was made in electric furnaces compared with 6 percent in 1948.

In 1949, 38.7 percent of the domestic steel output was made by furnaces in the Pittsburgh-Youngstown district, 22.0 percent in the Chicago district, 19.8 percent in the Eastern district, 9.0 percent in the Cleveland-Detroit district, 5.5 in the Western district, and 5.0 percent

in the Southern district, compared with 40.1, 21.7, 19.5, 8.5, 5.3, and 4.9 percent, respectively, in 1948.

The data concerning steel production used by the Bureau of Mines are furnished by the American Iron and Steel Institute. The output from steel foundries that do not produce steel ingots is not included in the production data.

Steel capacity, production, and percent of operations, 1945–49, in net tons [1]

[American Iron and Steel Institute]

Year	Annual capacity [2] as of Dec. 31	Production					
		Open hearth	Bessemer	Crucible	Electric	Total	Percent of capacity
1945	95, 505, 280	71, 939, 602	4, 305, 318	24	3, 456, 704	79, 701, 648	83. 5
1946	91, 890, 560	60, 711, 963	3, 327, 737	(3)	2, 563, 024	66, 602, 724	72. 5
1947	91, 241, 250	76, 873, 793	4, 232, 543	18	3, 787, 717	84, 894, 071	93. 0
1948	94, 233, 460	79, 340, 157	4, 243, 172	(3)	5, 057, 141	88, 640, 470	94. 1
1949	96, 120, 930	70, 248, 803	3, 946, 656	(3)	3, 782, 717	77, 978, 176	81. 1

[1] The figures include only that portion of the capacity and production of steel for castings used by foundrie which were operated by companies producing steel ingots.
[2] Capacity figures from A. I. S. I. Form 7.
[3] Included with "Electric."

Open-hearth steel ingots and castings manufactured in the United States, 1945–49, by States, in net tons [1]

[American Iron and Steel Institute]

State	1945	1946	1947	1948	1949
New England States	432, 601	367, 868	428, 651	454, 524	381, 763
New York and New Jersey	3, 813, 333	3, 242, 138	4, 213, 369	4, 277, 040	4, 020, 711
Pennsylvania	21, 194, 721	17, 495, 219	22, 911, 984	23, 648, 314	19, 759, 983
Ohio	13, 402, 084	11, 446, 783	14, 026, 978	14, 045, 722	12, 215, 389
Indiana	10, 237, 621	8, 359, 305	10, 128, 496	10, 453, 975	9, 099, 413
Illinois	5, 812, 286	4, 851, 975	6, 206, 370	6, 269, 723	5, 886, 460
Other States	17, 046, 956	14, 948, 675	18, 957, 945	20, 190, 859	18, 885, 084
Total	71, 939, 602	60, 711, 963	76, 873, 793	79, 340, 157	70, 248, 803

[1] Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots.

Bessemer-steel ingots and castings manufactured in the United States, 1945–49, by States, in net tons [1]

[American Iron and Steel Institute]

State	1945	1946	1947	1948	1949
Ohio	1, 930, 956	1, 447, 825	1, 981, 428	1, 936, 873	1, 760, 006
Pennsylvania	1, 388, 284	1, 143, 388	1, 345, 412	1, 355, 934	1, 174, 866
Other States	986, 078	736, 524	905, 703	950, 365	1, 011, 784
Total	4, 305, 318	3, 327, 737	4, 232, 543	4, 243, 172	3, 946, 656

[1] Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots.

Alloy Steel.—The steel output for 1949 includes 5,897,569 net tons of alloy steel ingots and castings, the lowest production of alloy steel since 1940. This production represents less than 8 percent of the total steel compared with 10 percent in 1948. The alloy-steel data include steels

Steel electrically manufactured in the United States, 1945–49, in net tons [1]

[American Iron and Steel Institute]

Year	Ingots	Castings	Total	Year	Ingots	Castings	Total
1945	3,381,678	75,026	3,456,704	1948	4,973,611	83,530	[2] 5,057,141
1946	2,479,064	83,960	[2] 2,563,024	1949	3,687,077	95,640	[2] 3,782,717
1947	3,680,500	107,217	3,787,717				

[1] Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots.
[2] Includes a very small quantity of crucible steel.

in which the minimum of the range specified, in one or more of the elements named, exceeds the following percentages: Manganese, 1.65 percent; silicon, 0.60 percent; copper, 0.60 percent, or aluminum, boron, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, and other alloying elements, any added percent. The output of alloy steels in 1949 decreased 30 percent from 1948, whereas total steel decreased only 12 percent. Of the alloy steel produced in 1949, 71 percent was made in basic open-hearth furnaces, 2 percent in acid open-hearths, and 27 percent in electric furnaces; none was produced in Bessemer converters.

Electric furnaces produced proportionately more alloy steel in 1949 than in 1948; 42 percent of the steel made in electric furnaces was alloy compared with 41 percent in the previous year. Typically, steels with high alloy content are made in electric furnaces and steels with lower content by the open-hearth process.

Alloy-steel ingots and castings manufactured in the United States, 1945–49, by processes, in net tons [1]

[American Iron and Steel Institute]

Process	1945	1946	1947	1948	1949
Open hearth:					
Basic	5,572,353	4,325,657	5,520,540	6,285,054	4,192,344
Acid	274,889	115,711	128,754	128,915	105,550
Crucible	18	1,635,827	1,778,937	2,067,145	1,599,675
Electric	2,800,451				
Total	8,647,711	6,077,195	7,428,231	8,481,114	5,897,569

[1] Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots.

Metalliferous Materials Used.—During 1949 steel furnaces used 3,152,797 net tons of domestic iron ore and 1,107,625 tons of foreign ore; the latter originated in Africa, Brazil, Canada, Cuba, and Sweden. Also used were 1,051,746 tons of sinter made from both foreign and domestic ores. Scrap and pig iron used in steel furnaces in 1949 totaled 86,930,717 net tons; of this, 54 percent was pig iron, 26 percent home scrap, and 20 percent purchased scrap. Both charge ore and feed ore are employed in the basic open-hearth process. Charge ore is used to add oxygen to the charge before it is melted. This ore should be low in combined and uncombined moisture, silica, and fines. Ore with a high silica content requires large additions of limestone

and consequently produces large volumes of slag, which reduces furnace efficiency. Iron-ore sinter has been found to be a good charge ore in open-hearth practice.

Feed ore, which is added to the heat during the working period, should be hard, dense, coarse, and low in moisture. Although moderately high silica ore can be used as feed, it is undesirable as a charge ore because of the large quantity of slag resulting. Lump ore, which is preferred as a feed ore, is high-priced, and the supply is limited. The Vermilion range in Minnesota and the Adirondack district in New York are the large source of this grade in the United States. Recently, large tonnages of high-grade lump ore have been obtained from Brazil.

Metalliferous materials consumed in steel furnaces in the United States, 1945–49, in net tons

Year	Iron ore		Sinter	Manganese ore		Pig iron	Ferro-alloys	Iron and steel scrap	
	Domestic	Foreign		Domestic	Foreign			Home	Purchased
1945	3,793,562	24,465	1,291,929	1,915	7,245	46,596,855	1,388,000	25,236,910	17,919,602
1946	3,117,774	446,611	769,640	2,364	2,110	38,443,934	1,044,000	19,868,551	16,513,487
1947	3,795,886	809,191	1,134,542	2,080	3,512	50,177,381	1,250,000	23,993,919	20,791,449
1948	3,808,155	1,064,513	1,114,032	2,698	4,159	52,177,785	1,300,000	24,689,529	22,890,571
1949	3,152,797	1,107,625	1,051,746	1,231	3,033	46,502,503	[1] 950,000	22,675,212	17,753,002

[1] Preliminary.

CONSUMPTION OF PIG IRON

Consumption of pig iron in 1949 decreased 11 percent from 1948. Pig iron, a product of the blast furnace, is a semiraw material; except for a small quantity used in direct castings, it moves to steel- or iron-melting furnaces for refining, alone or mixed with other ingredients. In 1949, 87 percent of the pig iron went to steel-making furnaces (open-hearth, Bessemer, and electric) to be processed into steel. Direct castings took 4 percent; and the remaining 9 percent was consumed in iron-making furnaces, of which the cupola is the most important. Gray-iron foundries used 10 percent less pig iron in 1949 than in 1948, but this was 9 percent of the total pig iron in 1949 as in 1948.

Consumption of pig iron in the United States, 1946–49, by type of furnace

Type of furnace or equipment	1946		1947		1948		1949	
	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total
Open-hearth	34,608,053	76.8	45,338,462	77.8	47,267,334	78.8	41,782,506	78.2
Bessemer	3,722,756	8.3	4,711,581	8.1	4,778,137	8.0	4,612,408	8.6
Electric	113,125	.3	127,338	.2	132,314	.2	107,589	.2
Cupola	4,612,704	10.2	5,438,727	9.3	5,280,957	8.8	4,764,003	8.9
Air; Brackelsberg	356,436	.8	413,900	.7	368,003	.6	273,514	.5
Crucible	985	(1)	1,312	(1)	1,013	(1)	1,052	(1)
Puddling	14,506	(1)	16,573	(1)	14,979	(1)	3,880	(1)
Direct castings	1,641,874	3.6	2,241,789	3.9	2,183,572	3.6	1,901,760	3.6
Miscellaneous	1,191	(1)	1,073	(1)	95	(1)	53	(1)
Total	45,071,630	100.0	58,290,755	100.0	60,026,494	100.0	53,446,765	100.0

[1] Less than 0.05 percent.

Consumption of pig iron in the United States, 1946–49, by States and districts

State and district	1946		1947		1948		1949	
	Consumers	Net tons	Consumers	Net tons	Consumers	Net tons	Consumers	Net tons
Connecticut	55	88,307	58	92,114	59	73,173	56	56,835
Maine	16	10,267	15	14,111	15	14,882	11	10,304
Massachusetts	94	154,654	98	199,258	100	219,453	95	174,401
New Hampshire	15	5,992	16	5,771	16	4,178	15	3,252
Rhode Island	10	28,339	12	31,036	11	23,520	11	32,217
Vermont	12	9,411	14	10,007	14	7,687	13	6,328
Total New England	202	296,970	213	352,297	215	342,893	201	283,337
Delaware	7	292,498	7	312,845	7	374,384	7	317,516
New Jersey [1]	77		76		80		78	
New York	179	2,201,586	172	2,966,882	174	2,948,785	170	2,652,854
Pennsylvania [1]	354	13,120,922	349	17,287,166	401	17,667,350	390	14,834,486
Total Middle Atlantic	617	15,615,006	604	20,566,893	662	20,990,519	645	17,804,856
Alabama	66	2,568,276	69	3,356,612	74	3,500,614	72	3,152,311
District of Columbia	1		1		3		2	
Kentucky [1]	24	2,629,314	24	3,150,317	25	3,640,266	22	3,593,087
Maryland [1]	21		19		23		21	
Florida	17	63,613	14	37,525	15	38,565	14	70,171
Georgia	52		49		51		50	
Mississippi	8	2,256	8	2,596	8	2,271	8	1,293
North Carolina	50	28,423	47	27,466	44	20,482	45	20,958
South Carolina	17	7,348	16	9,169	14	9,404	14	7,360
Tennessee	52	197,055	53	254,202	53	265,838	50	213,323
Virginia	53		54		51		49	
West Virginia	25	1,115,785	25	1,379,112	26	1,585,755	23	1,600,150
Total Southeastern	386	6,612,070	379	8,216,999	387	9,063,195	370	8,658,653
Arkansas	4		4		4		3	
Louisiana	12	5,620	11	5,766	12	7,025	12	6,015
Oklahoma	10		9		9		11	
Texas	37	54,138	37	120,091	38	230,947	37	198,318
Total South Central	63	59,758	61	125,857	63	237,972	63	204,333
Illinois [1]	208	3,716,293	208	4,782,722	216	4,809,697	209	4,498,693
Indiana	126	5,356,288	128	6,810,122	137	7,075,885	135	6,303,356
Iowa	58	104,744	54	98,116	50	91,291	52	107,353
Kansas	24	16,901	22	14,041	25	24,410	24	16,624
Nebraska	11		11		11		11	
Michigan	173	2,275,887	167	2,737,764	167	2,979,528	169	2,932,925
Wisconsin	115		116		125		121	
Minnesota	61	443,861	59	445,584	58	458,139	54	383,691
Missouri	52	93,298	51	80,926	51	87,654	49	63,524
North Dakota	1	316	1	225	1	235	1	261
South Dakota	1		1		1		1	
Ohio [1]	297	9,162,118	299	11,674,075	327	11,633,581	319	10,134,409
Total North Central	1,127	21,169,706	1,117	26,643,575	1,169	27,160,420	1,145	24,440,836
Arizona								
Nevada	5	1,022	4	1,215	4	1,251	4	1,194
New Mexico								
Colorado	26	761,468	26	1,511,704	30	1,583,437	31	1,364,097
Utah								
Idaho					2	315	2	194
Wyoming	4	1,547	5	3,041	2	4	2	5
Montana					4	320	4	305
Total Rocky Mountain	35	764,037	35	1,515,960	42	1,585,327	43	1,365,795
Oregon	32	33,795	26	17,812	23	20,849	23	15,342
Washington	31		31		29		35	
California [1]	123	520,288	116	635,164	111	625,229	108	673,613
Total Pacific Coast	186	554,083	173	652,976	163	646,078	166	688,955
Undistributed [1]			7	216,198				
Total United States	2,616	45,071,630	2,589	58,290,755	2,701	60,026,404	2,633	53,446,765

[1] In 1947 some pig iron consumed in California, Illinois, Kentucky, Maryland, New Jersey, Ohio, and Pennsylvania—not separable—is included with "Undistributed."

Plants using pig iron in 1949 were located in all 48 States and in the District of Columbia, but consumption is concentrated largely in the steel-making centers of the North Central, Middle Atlantic, and the Southeastern States. These areas used 95 percent of the pig iron in 1949; Pennsylvania (the leading consumer) took 28 percent of the total and Ohio (the second largest consumer) 19 percent.

PRICES

The average value of all grades of pig iron given in the accompanying table is compiled from producers' reports to the Bureau of Mines. The figures represent value f. o. b. blast furnaces and do not include the value of ferro-alloys. The general average value for all grades of pig iron at furnaces was $42.05 a net ton in 1949 compared with $37.17 in 1948.

Average value per net ton of pig iron at blast furnaces in the United States, 1945–49, by States

State	1945	1946	1947	1948	1949
Alabama	$18.39	$21.15	$28.12	$36.52	$35.79
California, Colorado, and Utah	19.49	21.25	30.50	40.93	42.92
Illinois	22.98	25.17	30.97	35.72	41.69
Indiana	23.11	25.46	30.57	37.86	41.26
Michigan	17.60	27.19	(1)	(1)	(1)
New York	22.83	22.82	27.54	32.70	43.81
Ohio	22.99	24.90	30.87	37.98	40.92
Pennsylvania	22.37	24.70	30.23	36.68	43.04
Other States [2]	20.48	24.95	31.67	38.77	44.59
Average for United States	22.01	24.49	30.34	37.17	42.05

[1] Included with "Other States."
[2] Comprises Kentucky, Maryland, Massachusetts, Michigan (1947–49 only), Minnesota, Tennessee, Texas, Virginia, and West Virginia.

The average monthly prices of foundry, Bessemer, and basic pig iron at Mahoning Valley furnaces and foundry pig at Birmingham furnaces, according to published market quotations, are summarized in the accompanying table.

Average monthly prices per net ton of chief grades of pig iron, 1948–49

[Metal Statistics, 1950]

Month	Foundry pig iron at Birmingham furnaces		Foundry pig iron at Valley furnaces		Bessemer pig iron at Valley furnaces		Basic pig iron at Valley furnaces	
	1948	1949	1948	1949	1948	1949	1948	1949
January	$32.28	$38.73	$35.06	$41.52	$35.51	$41.96	$34.62	$41.07
February	32.48	38.73	35.27	41.52	35.71	41.96	34.82	41.07
March	32.48	38.73	35.27	41.52	35.71	41.96	34.82	41.07
April	32.48	38.73	35.27	41.52	35.71	41.96	34.82	41.07
May	33.77	35.16	35.27	41.52	35.71	41.96	34.82	41.07
June	35.16	35.16	35.27	41.52	35.71	41.96	34.82	41.07
July	37.34	35.16	38.29	41.52	38.73	41.96	37.84	41.07
August	38.73	35.16	38.84	41.52	39.29	41.96	38.39	41.07
September	38.73	35.16	38.84	41.52	39.29	41.96	38.39	41.07
October	38.73	35.16	40.66	41.52	41.11	41.96	40.21	41.07
November	38.73	35.16	41.52	41.52	41.96	41.96	41.07	41.07
December	38.73	35.16	41.52	41.52	41.96	41.96	41.07	41.07
Average annual	35.80	36.35	37.58	41.52	38.04	41.96	37.14	41.07

Composite prices of finished steel in the United States, 1942–49, by months, in cents per pound

[Iron Age]

Month	1942	1943	1944	1945	1946	1947	1948	1949
January	2.396	2.396	2.396	2.412	2.464	2.877	3.193	3.720
February	2.396	2.396	2.396	2.427	2.555	2.884	3.125	3.719
March	2.396	2.396	2.396	2.432	2.719	2.884	3.241	3.715
April	2.396	2.396	2.396	2.433	2.719	2.884	3.241	3.709
May	2.396	2.396	2.396	2.436	2.719	2.884	3.214	3.706
June	2.396	2.396	2.396	2.464	2.719	2.884	3.211	3.705
July	2.396	2.396	2.396	2.464	2.719	2.914	3.293	3.705
August	2.396	2.396	2.396	2.464	2.719	3.193	3.720	3.705
September	2.396	2.396	2.396	2.464	2.719	3.193	3.720	3.705
October	2.396	2.396	2.396	2.464	2.719	3.193	3.720	3.705
November	2.396	2.396	2.396	2.464	2.719	3.193	3.720	3.705
December	2.396	2.396	2.396	2.464	2.747	3.193	3.720	3.756
Average annual	2.396	2.396	2.396	2.449	2.686	3.014	3.434	3.713

FOREIGN TRADE[2]

The ability of domestic furnaces to more nearly meet demands for pig iron in 1949 resulted in sharp decreases in imports in the United States during the year. Particularly noticeable were the lower receipts from France, Germany, Netherlands, and Norway.

Pig iron imported for consumption in the United States, by countries, 1945–49, in net tons

Country	1945	1946	1947	1948	1949
North America:					
Canada	21,433	1,287	1,747	5,729	12,270
Mexico		11,248	1,004		
South America:					
Argentina				2	
Brazil				551	
Europe:					
Austria			281	19,145	5,145
Belgium-Luxembourg				33,147	15,688
France				17,876	340
Germany				24,558	2,383
Italy				5,001	
Netherlands			2,711	[1] 48,101	20,527
Norway			9,482	[1] 23,919	146
Poland-Danzig			7,466		
Sweden		28		1,301	436
U. S. S. R.			1,357		
United Kingdom		1,528	8,576		193
Asia: India				16,101	23,077
Oceania: Australia				26,902	19,599
Total: Net tons	21,433	14,091	32,624	[1] 222,333	99,804
Value	$440,283	$492,519	$1,738,812	[1] $11,977,534	$4,591,779

[1] Revised figure.

Relaxation of export controls in 1949 resulted in large increases of pig-iron exports to Canada, United Kingdom, and Korea during the year. Exports increased from 7,032 net tons ($217,237) in 1948 to 81,309 tons ($3,353,602) in 1949. Of the 1949 total, 46,990 tons went to United Kingdom, 19,163 to Canada, 8,346 to Korea, 2,280 to Mexico, 1,690 to Greece, and the remaining 2,840 tons, in small lots, principally to Central and South America.

[2] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Imports and exports of iron and steel products are given in detail in the following tables. Imports of semimanufactures—steel ingots, blooms and slabs, steel bars and plates, and tin plate—increased considerably. Of the manufactures, structural showed the largest tonnage increase during the year. Exports of semimanufactures and manufactures increased slightly.

Iron and steel imported for consumption in the United States, 1947–49,[1] by products

[U. S. Department of Commerce]

Product	1947		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value
Semimanufactures:						
Steel bars:						
Concrete reinforcement bars	2	$191	790	$79,008	10,269	$1,254,076
Solid or hollow, n. e. s.	687	161,230	5,007	527,480	35,268	3,007,463
Hollow and hollow drill steel	37	7,515	63	15,148	92	21,438
Bar iron	250	46,526	191	38,825	353	80,200
Wire rods, nail rods, and flat rods up to 6 inches in width	6,018	906,483	6,607	1,045,595	5,732	27,926
Boiler and other plate iron and steel, n. e. s.	663	52,652	21,735	2,145,259	30,519	2,988,108
Steel ingots, blooms, and slabs	1,513	68,353	17,885	969,595	50,310	3,312,902
Billets, solid or hollow	4	798	5,399	441,416	2,002	165,969
Die blocks or blanks, shafting, etc.	240	79,054	48	16,475	660	61,626
Circular saw plates	2	1,632	5	3,090	2	1,016
Sheets of iron or steel, common or black and boiler or other plate iron or steel	750	58,819	8,601	[2] 1,210,420	3,572	396,433
Sheets and plates and steel, n. s. p. f.	431	48,941	3,988	409,026	9,266	865,110
Tin plate, terneplate, and taggers' tin	655	192,853	207	74,631	13,684	2,052,030
Total semimanufactures	11,252	1,625,047	70,526	[2] 6,975,968	161,729	14,234,297
Manufactures:						
Structural iron and steel	1,730	257,073	[2] 65,830	[2] 6,565,705	119,506	11,895,706
Rails for railways	8,859	211,223	5,063	266,032	944	76,459
Rail braces, bars, fishplates, or splice bars and tie plates	1,408	57,188	1,721	66,200	162	16,452
Pipes and tubes:						
Cast-iron pipe and fittings	59	10,155	1,981	341,206	256	39,823
Other pipes and tubes	6,228	1,519,443	2,561	290,966	5,459	1,154,349
Wire:						
Barbed	(3)	32	(3)	24	100	11,653
Round wire, n. e. s.	97	25,423	25	14,482	2,308	245,907
Telegraph, telephone, etc., except copper, covered with cotton jute, etc.	122	28,949	2	2,337	456	241,344
Flat wire and iron or steel strips	2,634	1,885,742	2,125	1,907,705	1,574	1,598,381
Rope and strand	312	92,438	280	107,963	891	380,756
Galvanized fencing wire and wire fencing	3	308	(3)	53	7	786
Hoop or band iron or steel, for baling	------	------	545	53,615	2,960	284,033
Hoop, band and strips, or scroll iron or steel, n. s. p. f.	35	48,058	[2] 2,445	[2] 276,344	5,647	511,081
Nails	116	51,357	2,045	459,691	2,384	429,188
Castings and forgings, n. e. s.	1,216	303,499	660	197,245	196	67,149
Total manufactures	22,819	4,490,888	[2] 85,283	[2] 10,549,568	142,850	16,953,067
Grand total	34,071	6,115,935	[2] 155,809	[2] 17,525,536	304,579	31,187,364

[1] 1946 revisions for table in Minerals Yearbook, 1948, p. 677 are as follows: Billets, solid or hollow should read 604 tons ($43,216); total semimanufactures, 11,471 tons ($1,465,456); cast-iron pipe and fittings, 218 tons; other pipes and tubes, $26,032; flat wire and iron or steel strips, 2,816 tons ($2,095,176); nails, $53,157; castings and forgings, n. e. s., $218,735; total manufactures, 14,005 tons ($2,937,111); grand total, 25,476 tons ($4,402,567).

[2] Revised figure.

[3] Less than 1 ton.

Iron and steel exported from the United States, 1947–49, by products

[U. S. Department of Commerce]

Products	1947		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value
Semimanufactures:						
Steel ingots, blooms, billets, slabs, and sheet bars	491, 215	$32, 490, 308	219, 340	$16, 737, 092	257, 248	$21, 546, 322
Iron and steel bars and rods:						
Iron bars	34, 752	3, 948, 426	3, 659	533, 323	1, 470	322, 745
Concrete reinforcement bars	248, 373	23, 191, 211	130, 298	12, 804, 067	107, 902	10, 386, 873
Other steel bars	850, 126	91, 421, 172	408, 977	47, 285, 914	332, 387	39, 949, 878
Wire rods	71, 237	7, 116, 964	38, 143	3, 763, 553	53, 315	5, 019, 109
Iron and steel plates, sheets, skelp, and strips:						
Plates, including boiler plate, not fabricated	562, 480	47, 848, 952	347, 097	33, 447, 860	417, 097	41, 542, 588
Skelp iron and steel	67, 403	3, 451, 166	57, 920	3, 370, 867	117, 369	8, 467, 977
Iron and steel sheets, galvanized	74, 440	10, 511, 185	62, 782	8, 211, 687	85, 594	13, 071, 223
Steel sheets, black, ungalvanized	568, 760	85, 165, 592	416, 481	57, 396, 092	551, 245	74, 987, 636
Iron sheets, black	30, 215	3, 753, 982	17, 773	2, 008, 229	22, 650	2, 638, 541
Strip, hoop, band, and scroll iron and steel:						
Cold-rolled	89, 618	17, 507, 117	59, 483	12, 405, 506	57, 376	12, 591, 131
Hot-rolled	107, 149	10, 963, 981	69, 094	7, 569, 374	82, 376	9, 224, 040
Tin plate and terneplate	620, 198	86, 917, 802	613, 785	97, 102, 604	558, 173	95, 662, 968
Total semimanufactures	3, 815, 966	424, 287, 858	2, 445, 432	302, 636, 168	2, 644, 202	335, 411, 031
Manufactures—steel-mill products:						
Structural iron and steel:						
Water, oil, gas, and other storage tanks complete and knocked-down material	98, 234	15, 178, 585	92, 448	15, 327, 353	106, 003	19, 037, 149
Structural shapes:						
Not fabricated	463, 375	32, 519, 487	292, 176	23, 388, 444	302, 700	25, 680, 402
Fabricated	246, 122	38, 812, 416	[1] 161, 504	[1] 38, 014, 226	152, 942	36, 482, 820
Plates, fabricated, punched, or shaped	36, 876	4, 199, 751	23, 551	3, 728, 580	30, 366	6, 339, 113
Metal lath	5, 717	1, 216, 971	7, 233	1, 661, 125	5, 166	1, 259, 732
Frames, sashes, and sheet piling	[1] 37, 576	[1] 4, 296, 423	[1] 38, 253	[1] 4, 792, 560	22, 501	3, 793, 458
Railway-track material:						
Rails for railways	500, 582	31, 732, 249	308, 375	[1] 22, 822, 159	236, 990	19, 416, 144
Rail joints, splice bars, fishplates, and tie plates	119, 411	9, 897, 099	49, 356	5, 085, 002	22, 680	3, 100, 755
Switches, frogs, and crossings	[1] 7, 190	[1] 1, 632, 127	5, 467	1, 430, 134	6, 043	1, 674, 188
Railroad spikes	23, 459	2, 684, 325	9, 268	1, 283, 138	3, 634	544, 619
Railroad bolts, nuts, washers, and nut locks	7, 759	1, 603, 871	7, 666	1, 852, 157	1, 994	508, 375
Tubular products:						
Boiler tubes	69, 836	13, 267, 387	38, 455	7, 784, 355	47, 070	9, 770, 150
Casing and oil-line pipe	333, 377	40, 121, 614	371, 914	48, 626, 644	491, 644	71, 878, 447
Seamless black pipe, other than casing and oil line	18, 717	2, 856, 028	21, 692	3, 377, 439	26, 249	4, 348, 194
Welded black pipe and tubes	88, 876	10, 767, 626	61, 560	9, 700, 712	101, 766	15, 710, 248
Welded galvanized pipe and tubes	70, 219	11, 577, 836	41, 761	7, 944, 365	98, 536	17, 826, 791
Malleable-iron screwed pipe fittings	5, 164	2, 887, 552	4, 490	3, 327, 067	5, 573	4, 132, 077
Cast-iron screwed pipe fittings	2, 946	1, 279, 105	2, 650	906, 486	752	294, 867
Cast-iron pressure pipe and fittings	41, 040	3, 575, 451	32, 066	3, 823, 795	47, 564	5, 646, 816
Cast-iron soil pipe and fittings	5, 602	849, 972	4, 568	904, 290	10, 165	1, 809, 149
Iron and steel pipe and fittings, n. e. s.	101, 850	30, 914, 371	68, 938	29, 075, 781	68, 873	32, 998, 901
Wire and manufactures:						
Barbed wire	84, 346	12, 093, 216	76, 827	11, 818, 185	75, 737	11, 666, 175
Galvanized wire	101, 026	19, 428, 575	50, 314	9, 426, 895	56, 902	9, 591, 071
Iron and steel wire, uncoated	78, 862	12, 322, 992	39, 789	6, 096, 728	73, 828	11, 524, 306
Wire rope and strand	30, 829	10, 319, 192	13, 643	4, 845, 673	12, 915	5, 286, 181
Woven-wire fencing and screen cloth	18, 356	7, 481, 477	17, 357	6, 983, 470	20, 615	7, 008, 457
All other	67, 443	18, 513, 762	57, 352	15, 733, 926	36, 191	10, 439, 244

See footnote at end of table.

Iron and steel exported from the United States, 1947–49, by products—Continued

Products	1947		1948		1949	
	Net tons	Value	Net tons	Value	Net tons	Value
Manufactures, etc.—Continued.						
Nails and bolts, iron and steel, n. e. s:						
Wire nails	25,754	$3,915,832	19,662	$3,358,447	25,910	$4,187,757
All other nails, including tacks and staples	15,995	4,083,467	14,914	4,384,450	11,571	3,178,429
Bolts, machine screws, nuts, rivets, and washers, n. e. s	48,323	15,487,672	54,311	16,908,269	26,129	12,045,325
Castings and forgings:						
Horseshoes, mule shoes, and calks	897	178,977	582	112,854	418	90,463
Iron and steel, including car wheels, tires, and axles	191,292	24,307,976	116,763	19,531,742	136,126	22,580,115
Total manufactures	[1] 2,947,051	[1] 390,003,384	[1] 2,104,905	[1] 334,056,451	2,265,553	379,849,918
Advanced manufactures:						
House-heating boilers and radiators		1,898,479		854,207		736,209
Oil burners and parts		15,903,984		3,976,851		4,802,112
Tools (iron and steel chief value)		69,768,347		52,545,439		46,872,436
Total advanced manufactures		87,570,810		57,376,497		52,410,757

[1] Revised figure.

WORLD PRODUCTION

World production of steel in 1949 increased slightly over 1948 despite the 12-percent drop in United States output. Notable increases occurred in the U. S. S. R., the world's second largest producer, and Germany, which attained its largest postwar production although the rate was less than in any war year, due in part to limitations imposed by the Allied Control Authority. Japanese production increased in 1949 but was restricted by raw-material shortages.

Australia.—The Broken Hill Pty. Co., Ltd. (B. H. P.), was permitted by the Capital Issues Advisory Committee to increase its capital £6,942,450. The new capital is to be used for expansion of the B. H. P. and its principal subsidiary, Australian Iron & Steel Ltd., including mechanization of coal mines, building of ore-carrying vessels, development of iron-ore property at Cockatoo Island, and completion of a new rolling mill, coke ovens, hot and cold strip mill, and tin-plate plant at Port Kembla.[3] B. H. P. and Australian Iron and Steel Ltd. produce all of the iron and steel in Australia.

Chile.—An agreement was signed early in 1949 between the Bethlehem Chile Iron Mines, a subsidiary of Bethlehem Steel Co., and Compania de Acero del Pacifico; the agreement is reported to include the development of the El Romeral iron-ore deposits in La Serena Department and is to begin within 3 years.[4]

Colombia.—A report by Koppers Co., Inc., for the Institute de Fomento Industrial on the proposed steel plant at Belencito near Sogamoso, Department of Boyaca, Colombia, was completed during 1949; the plant is designed to produce 193,530 tons of iron and steel products during the first year (1953) and increase to 216,300 tons annually at the end of 1957; the ore for this operation will come from Paz de Rio, where reserves are stated to be 20,400,000 tons of iron ore

[3] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 3, September 1949, p. 14.
[4] Metal Bulletin (London), No. 3383, Apr. 12, 1949, p. 10.

World production of pig iron (including ferro-alloys), by countries, 1943–49, in metric tons [1]

[Compiled by Pauline Roberts]

Country [1]	1943	1944	1945	1946	1947	1948	1949
Australia [2]	1,421,765	1,326,308	1,135,648	920,829	1,161,479	1,255,405	1,058,000
Austria	965,000	926,178	101,549	57,868	278,505	613,209	837,748
Belgium	1,630,570	718,490	734,580	2,160,830	2,816,780	3,936,909	3,742,761
Brazil	248,376	292,169	259,909	370,722	480,929	551,813	508,219
Canada	1,773,866	1,836,088	1,774,497	1,407,285	1,986,698	2,151,439	2,146,347
Chile	9,256	5,948	6,847	14,000	11,394	14,000	(3)
China	[4] 1,867,507	[4] 2,121,574	493,575	[5] 31,000	[5] 35,733	[5, 6] 47,400	[6, 7] 172,000
Czechoslovakia	1,704,000	1,584,000	576,000	961,000	1,422,466	1,660,000	1,875,000
Finland	43,277	100,303	36,798	77,088	70,637	90,049	101,211
France	4,920,730	2,892,694	1,197,142	3,494,258	4,892,720	6,559,000	8,355,000
Saar	2,337,000	1,689,000	(8)	246,500	652,900	1,134,000	1,581,000
French Indochina	2,922	1,926			(3)		
Germany	15,972,000	13,370,000	[9, 10] 1,123,000	[11] 2,330,300	[11] 2,512,092	[11] 5,630,399	[11] 7,659,000
Hungary	420,620	[12] 396,260	[12] 43,700	160,180	299,460	[6] 350,000	428,000
India	1,776,941	1,453,713	1,424,652	1,480,955	1,567,380	1,494,431	1,596,833
Italy	734,207	305,066	71,355	204,500	384,000	526,072	444,998
Japan	4,109,900	2,787,400	984,200	211,800	367,000	836,455	1,602,200
Korea:							
North	543,492	567,856	141,308	[6] 10,000	[6] 20,000	(3)	(3)
South							
Luxembourg	2,289,740	1,348,096	316,477	1,364,400	1,818,160	2,626,300	2,371,580
Mexico [13]	126,325	135,157	218,322	282,243	235,620	270,391	355,760
Netherlands	94,000	67,000	25,000	186,800	287,990	442,000	(3)
Norway	144,855	123,745	50,995	135,410	165,320	214,719	230,415
Poland	741,700	690,900	228,249	725,736	867,121	1,133,000	(3)
Rumania	172,806	140,736	53,862	65,867	89,924	[6] 80,000	[6] 200,000
Spain	697,318	564,294	488,414	509,441	517,180	537,240	632,438
Sweden	831,769	888,219	785,359	719,336	724,569	803,586	801,000
Switzerland	15,400	29,400	2,770	11,500	[6] 12,000	[6] 30,000	[6] 32,000
Turkey	55,259	69,795	69,524	78,886	99,027	166,467	112,700
Union of South Africa	486,800	471,520	555,700	560,000	630,000	651,100	708,400
U. S. S. R. [6]	5,500,000	7,210,000	8,730,000	10,000,000	11,200,000	12,770,000	15,000,000
United Kingdom	7,302,250	6,844,621	7,221,474	7,885,564	7,909,543	9,425,286	9,652,881
United States	56,969,248	57,059,457	49,855,561	42,023,299	54,558,725	56,214,008	49,774,775
Yugoslavia	(3)	(3)	12,000	84,000	163,000	172,000	[6] 225,000
Total (estimate)	116,000,000	108,000,000	79,000,000	79,000,000	100,000,000	113,000,000	115,000,000

[1] Pig iron is also produced in Belgian Congo, New Zealand, and the Philippines, but quantity produced is believed insufficient to affect estimate of world total.
[2] Data for fiscal year ended June 30 of year stated.
[3] Data not available; estimate by author of chapter included in total.
[4] Includes Manchuria.
[5] Excludes Manchuria; estimate included in total.
[6] Estimate.
[7] Manchuria only; estimate for balance of China included in total.
[8] Included with Germany.
[9] January, February, September–December inclusive, only.
[10] Excludes Russian Zone.
[11] Bizonal area.
[12] Data represent Trianon Hungary after October 1944.
[13] Excluding ferro-alloy production, for which data are not yet available.

and 1,500,000 tons of manganiferous ore. The iron ore is said to contain 47 percent Fe and 16 percent SiO_2, some AO_2O_3, with a 12-percent ignition loss. Coal and other raw materials are said to be available in areas easily accessible to the plant site.[5]

Germany: Soviet Zone.—In the Soviet Zone of Germany, rolled-steel production in 1948 has been given as 230,000 metric tons, of which 80,000 tons came from the Hüttenwerk Thale and 130,000 tons from Maximilianhütte; these two operations were transferred to Russian ownership in 1945 and continued in operation, while the remaining iron and steel works at Riesa, Gröditz, Döhlen, Brandenburg, and Henningsdorf were largely dismantled. In 1947 authorization was granted by the Soviet Military Government for reconstruction of the

[5] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 3, September 1949, p. 15.

World production of steel ingots and castings, by countries, 1945–49, in metric tons

[Compiled by Berenice B. Mitchell and Pauline Roberts]

Country	1945	1946	1947	1948	1949
Australia [1]	1,420,000	1,114,000	1,371,000	1,176,439	1,188,000
Austria	171,598	187,008	356,609	648,181	834,574
Belgium	749,160	2,296,570	2,881,880	3,893,820	3,818,323
Brazil	205,935	342,613	386,971	483,085	605,451
Canada	2,610,798	2,111,266	2,672,509	2,903,411	2,891,119
Chile	14,000	9,000	12,000	13,000	31,560
China	18,234	[2] 15,700	18,517	[2] 11,400	[2] 100,000
Manchuria	[2] 150,000				
Czechoslovakia	947,985	1,668,000	2,286,000	2,650,000	[2] 2,903,000
Denmark					[2] 81,000
Finland	86,006	90,035	81,183	108,715	113,632
France	1,660,983	4,408,118	5,732,837	7,242,925	9,108,000
Saar	[3] 7,600	291,000	708,000	1,228,000	1,757,000
Germany, Federal Republic	291,996	2,837,641	3,765,687	5,559,914	9,156,000
Hungary	128,398	352,794	596,791	742,345	890,000
India	1,374,512	1,321,881	1,281,341	1,224,700	1,264,124
Italy	394,756	1,153,293	1,691,453	2,125,147	2,055,499
Japan	2,082,408	564,456	941,328	1,713,828	3,111,400
Korea:					
North	27,903	[2] 15,000	[2] 50,000	(4)	(4)
South		(4)			
Luxembourg	259,091	1,295,294	1,714,297	2,452,844	2,271,858
Mexico	192,033	250,761	321,377	268,800	[2] 358,300
Netherlands	13,000	138,000	190,000	[2] 200,000	[2] 445,000
Norway	34,400	51,500	64,514	63,331	72,000
Poland	495,029	1,219,426	1,579,120	1,954,000	2,297,300
Rumania	117,729	147,989	179,368	[2] 200,000	[2] 260,000
Spain	758,006	575,362	548,269	623,696	648,517
Sweden	1,203,447	1,202,769	1,190,702	1,256,917	1,366,400
Switzerland	90,000	34,000	92,000	80,000	[2] 120,000
Turkey	64,185	79,894	92,562	99,000	[2] 118,000
Union of South Africa	533,833	506,934	597,746	596,983	631,516
U. S. S. R. [2]	12,000,000	13,000,000	14,000,000	18,300,000	21,600,000
United Kingdom	12,013,775	12,899,060	12,928,728	15,115,369	15,801,600
United States [5]	72,303,741	60,420,659	77,014,203	80,412,862	70,740,242
Yugoslavia	67,000	202,000	311,000	[2] 368,000	[2] 390,000
Total	112,500,000	110,800,000	135,700,000	153,700,000	157,000,000

[1] Fiscal year ended June 30 of year stated.
[2] Estimate.
[3] September to December, inclusive.
[4] Data not available.
[5] Data from American Iron and Steel Institute. Excludes production of castings by companies that do not produce steel ingots.

Riesa and Henningsdorf works and the return of Maximilianhütte to the Government of Thuringia. Reconstruction, however, has been very slow, and it is doubtful whether production in the Soviet Zone exceeded 500,000 tons in 1949.[6]

Israel.—A rolling mill for the production of reinforcing bars and light structural shapes was purchased in France and delivered to Haifa in 1949. The capacity of the mill is given as 40,000 tons annually.[7] Plans were made public later in the year for a plant to be constructed at Tel Aviv for production of steel as well as fabrication.[8]

Norway.—Plans were furthered in 1949 for construction of a proposed steel plant in northern Norway, mentioned in Minerals Yearbook, 1947.[9] The capacity goal has been given as 500,000 tons of finished products per year. Iron ore will probably come from the large deposits at Dunderland.[10]

[6] Metal Bulletin (London), No. 3416, Aug. 16, 1949, p. 13.
[7] Metal Bulletin (London), No. 3422, Sept. 6, 1949, p. 12.
[8] Metal Bulletin (London), No. 3440, Nov. 8, 1949, p. 13.
[9] Bureau of Mines, Minerals Yearbook, 1947, p. 643.
[10] Metal Bulletin (London), No. 3374, Mar. 11, 1949, p. 10.

Iron and Steel Scrap

By James E. Larkin

GENERAL SUMMARY

WIDE fluctuations in price and consumption of ferrous scrap were experienced by the scrap industry during 1949. Steel mills operated at more than 100 percent of capacity during the first quarter of 1949 and used more scrap than they were able to obtain, the difference in their metal charges being made up by drawing from their inventories. Heavy collections of scrap were made during the mild winter months, which resulted in less scrap being available in the second quarter. Thereafter, steel mills continued to purchase less scrap, and prices dropped precipitously to the lowest level in 5 years. Surplus scrap, which had been made available by the Government during 1948, was about exhausted; hence consumers could not rely upon this source of scrap to replenish their stocks. The higher prices paid during 1948 had enabled small dealers and collectors to operate and had brought out a large enough supply to permit a new record consumption of purchased scrap in that year and a 60-percent increase in consumers' stocks at the end of 1948. However, the drop in scrap prices during 1949 to nearly the Office of Price Administration wartime level caused some of these dealers and collectors to discontinue operations, thus decreasing this source of supply.

A 12-percent drop during 1949 from 1948 in the output of steel ingots and castings was accompanied by a 16-percent decrease in the use of scrap and a 14-percent decrease in the use of all ferrous materials. The demand for steel remained high during the first quarter of the year; however, production was curtailed during the balance of the year owing to lack of demand resulting from a general business recession in the second and third quarters, strikes in associated industries, and a costly steel strike beginning October 1 and lasting until November 11.

Stocks of purchased scrap held by consumers decreased each month after January and continued to decrease until the end of September, when they reached the 1949 low of 3,292,000 short tons. The steel strike curtailed the consumption of purchased scrap; however, consumers were obliged to accept some commitments for scrap to be delivered during October and November, resulting in an increase in inventories up to the end of the year. Although stocks had increased at the end of the year, they were still 16 percent lower than at the beginning of the year and were equivalent to a 59-day supply at the 1949 average daily consumption rate of 68,964 short tons.

As a result of the steel strike, the estimated use of ferrous scrap and pig iron in steel-making furnaces during October (1,080,000 net tons) dropped to a level lower than in any month since collection of monthly statistics by the Bureau of Mines was begun in July 1941. In contrast to this low level in October, the Bureau of Mines estimated that a record total of 9,418,000 net tons of ferrous materials was used in

steel-making furnaces during March in producing an all-time high of 8,401,796 net tons of steel ingots and castings. This record consumption was achieved by melting a new high of 4,991,000 net tons of pig iron; purchased scrap was the highest (2,116,000 net tons) since March 1948 and home scrap (2,311,000 net tons) the highest since March 1945.

Salient statistics of ferrous scrap and pig iron in the United States, 1948–49

	1948 (short tons)	1949 (short tons)	Percent of change from 1948
Stocks, December 31: Ferrous scrap and pig iron at consumers' plants:			
Home scrap	1,598,673	1,564,054	−2
Purchased scrap	4,859,463	4,076,805	−16
Pig iron	1,606,160	1,657,634	+3
Total	8,064,296	7,298,493	−9
Consumption: Ferrous scrap and pig iron charged to—			
Steel furnaces: [1]			
Home scrap	24,689,529	22,675,212	−8
Purchased scrap	22,890,571	17,753,002	−22
Pig iron	52,177,785	46,502,503	−11
Total	99,757,885	86,930,717	−13
Iron furnaces: [2]			
Home scrap	7,656,258	6,435,943	−16
Purchased scrap	8,129,363	6,233,123	−23
Pig iron	7,848,524	6,944,209	−12
Total	23,634,145	19,613,275	−17
Miscellaneous uses [3] and ferro-alloy production:			
Home scrap	73,856	55,338	−25
Purchased scrap	1,524,298	1,185,605	−22
Pig iron	95	53	−44
Total	1,598,249	1,240,996	−22
All uses:			
Home scrap	32,419,643	29,166,493	−10
Purchased scrap	32,544,232	25,171,730	−23
Total ferrous scrap	64,963,875	54,338,223	−16
Pig iron	60,026,404	53,446,765	−11
Grand total	124,990,279	107,784,988	−14
Imports of scrap (including tin-plate scrap)	[4] 480,724	1,140,364	+137
Exports of scrap:			
Iron and steel	[4] 208,246	294,960	+42
Tin-plate circles, strips, cobbles, etc	[4] 3,948	3,634	−8
Average prices per gross ton:			
Scrap:			
No. 1 Heavy-Melting, Pittsburgh [5]	$41.36	$29.08	−30
No. 1 Cast Cupola, Chicago [5]	$70.48	$39.07	−45
For export	[4] $37.77	$27.54	−27
Pig iron, f. o. b. Valley furnaces: [5]			
Basic	$41.62	$46.00	+11
No. 2 Foundry	$42.12	$46.50	+10

[1] Includes open-hearth, Bessemer, and electric furnaces.
[2] Includes cupola, air, Brackelsberg, puddling, crucible, and blast furnaces; also direct castings.
[3] Includes rerolling, reforging, copper precipitation, nonferrous, and chemical uses.
[4] Revised figure.
[5] Iron Age.

The Scrap Drive Committee appointed during November 1948 by the Secretary of Commerce to assist the Office of Industry Cooperation in a Nation-wide industrial iron- and steel-scrap drive was asked in April 1949 to terminate the campaign as of May 15, because of

improvement in the scrap supply situation. The Secretary of Commerce stated, in connection with termination of this drive:

> Although the quantities of scrap available at the moment are adequate to take care of the country's needs for peacetime operations, it should be made plain that there is no excessive quantity of scrap in the United States. If steel production is to continue at the present high rate and if consumer demands for steel products are to be met, a constant flow of heavy scrap to the steel mills and foundries must be maintained.

He stated further that:

> In commenting on the report of the scrap mission which recently returned from Japan, we do not have the amount of scrap needed in case of an emergency, and the stockpiling of high-grade steel scrap is, in my opinion, desirable.

A four-man mission arrived in Japan in January 1949, to survey the availability of heavy iron and steel scrap in that country. The mission, sponsored by the United States Department of Commerce and the Army, surveyed the scrap and steel industries of Japan so that they could recommend how much scrap the Japanese economy could spare for shipment to the United States. The mission reported that supplies in Japan would amount to more than 5,512,000 short tons.[1] Shipments from that country to the United States have expanded greatly since 1947.

Purchased-scrap stocks as of December 31, 1948, were 4,859,463 short tons and as of January 31, 1949, 4,545,000 short tons. These were the highest stocks held by consumers at any time since the Bureau of Mines has published data on consumers' inventories. These high stocks were evidently a direct result of the scrap drive instigated by the United States Department of Commerce and in the increase from foreign countries.

During April there was a tendency in industry and Government circles toward the stockpiling of iron and steel scrap; however, the Subcommittee on Scrap of the Iron and Steel Industry Advisory Committee of the Munitions Board did not recommend that scrap be stockpiled.

CONSUMPTION

Although there was an over-all reduction in the use of scrap and pig iron in 1949, there was still a noticeably large use of scrap as compared with pig iron in the New England, Pacific Coast, and Southwestern districts. These districts together, as in 1948, used 7 percent of the total scrap consumed in the United States but only 2 percent of the pig iron. The average ratio of scrap to pig iron in these three districts was 3.1:1, whereas for the United States at large it was 1.0:1.

Open-hearth furnaces were still the largest consumers of ferrous scrap and pig iron; however, there was a decrease from 1948 of 5,100,693 tons of scrap and 5,484,828 tons of pig iron used in 1949. Open-hearth consumption accounted for 65 percent of the total scrap in 1949 and 63 percent in 1948; 71 percent of the home scrap in 1949 and 68 percent in 1948; and 59 percent of the purchased scrap in 1949 and 57 percent in 1948. Pig-iron consumption in open hearths

[1] Metal Bulletin (London), No. 3391, May 13, 1949, p. 16.

accounted for 78 percent of the total pig iron consumed in 1949 and 79 percent in 1948.

Cupola-furnace consumption in 1949 was as follows: Home scrap, 15 percent of the total, compared with 16 percent in 1948; purchased scrap, 18 percent, compared with 19 percent in 1948; pig iron, 9 percent in 1949, 1948, and 1947, compared with 10 percent in 1946.

Bessemer converters consumed 9 percent of the pig iron during 1949 compared with 8 percent for the 3 previous years and 0.4 percent of the scrap, the same as in 1948.

Electric furnaces consumed 9 percent of the total scrap, or 1 percent less than in 1948, and 0.2 percent of the pig iron, unchanged from 1947–48.

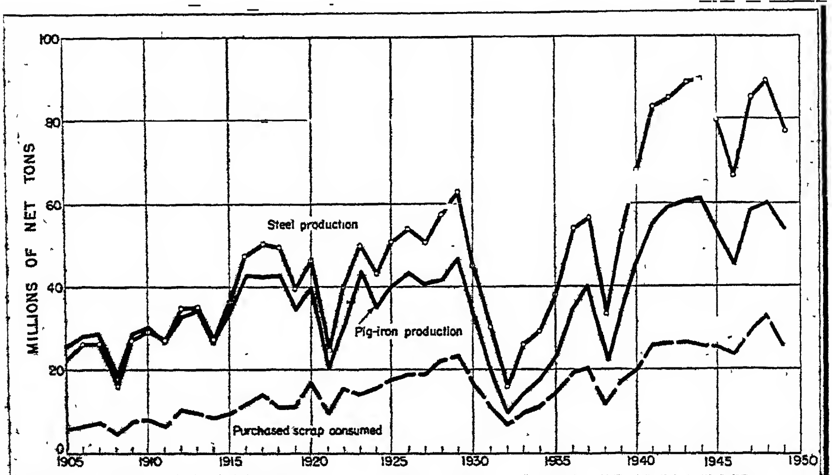

FIGURE 1.—Consumption of purchased scrap and output of pig iron and steel in the United States, 1905–49. Figures on consumption of purchased scrap for 1905–32 are from State of Minnesota vs. Oliver Iron Mining Co., et al., Exhibits, vol. 5, 1935, p. 328; those for 1933–34 are estimated by authors; and those for 1935–49 are based on Bureau of Mines reports. Data on steel output from the American Iron and Steel Institute.

Ferrous scrap and pig iron consumed in the United States and percent of total derived from home scrap, purchased scrap, and pig iron, 1948–49, by districts

District	1948					1949				
	Total used (short tons)	Percent of total used				Total used (short tons)	Percent of total used			
		Scrap			Pig iron		Scrap			Pig iron
		Home	Purchased	Total			Home	Purchased	Total	
New England	1,434,132	30.9	45.2	76.1	23.9	1,048,785	32.9	40.1	73.0	27.0
Middle Atlantic	40,957,933	25.8	23.0	48.8	51.2	34,105,774	26.5	21.3	47.8	52.2
Southeastern	16,467,121	24.0	21.0	45.0	55.0	15,188,675	24.8	18.2	43.0	57.0
Southwestern	1,045,433	22.4	54.9	77.3	22.7	889,495	22.1	54.9	77.0	23.0
North Central	58,760,287	26.7	27.1	53.8	46.2	51,049,688	28.2	23.9	52.1	47.9
Rocky Mountain	2,921,947	25.8	20.0	45.8	54.2	2,590,748	26.1	21.2	47.3	52.7
Pacific Coast	3,403,426	22.6	58.4	81.0	19.0	2,911,823	26.0	50.3	76.3	23.7
Total	124,990,279	25.9	26.1	52.0	48.0	107,784,938	27.1	23.3	50.4	49.6

Proportion of home and purchased scrap and pig iron used in furnace charges in the United States, 1948–49, in percent

Type of furnace	1948				1949			
	Scrap			Pig iron	Scrap			Pig iron
	Home	Purchased	Total		Home	Purchased	Total	
Open-hearth	25.1	21.1	46.2	53.8	26.7	19.3	46.0	54.0
Bessemer	3.9	1.1	5.0	95.0	3.5	.8	4.3	95.7
Electric	34.9	63.2	98.1	1.9	38.5	59.3	97.8	2.2
Cupola	31.8	36.7	68.5	31.5	32.2	32.6	64.8	35.2
Air [1]	50.5	28.5	79.0	21.0	50.3	26.4	76.7	23.3
Crucible	25.0	31.8	56.8	43.2	26.6	26.9	53.5	46.5
Puddling	1.1	23.2	24.3	75.7	14.9	27.0	41.9	58.1
Blast	49.5	50.5	100.0	--------	49.7	50.3	100.0	--------

[1] Includes data for 2 Brackelsberg furnaces.

Consumption of ferrous scrap and pig iron in the United States, 1948–49, by type of furnace, in short tons

Type of furnace or equipment	Active plants reporting [1]	Scrap			Pig iron
		Home	Purchased	Total	
1948					
Open-hearth	126	22,107,617	18,515,530	40,623,147	47,267,334
Bessemer	30	197,890	53,560	251,450	4,778,137
Electric	320	2,384,022	4,321,481	6,705,503	132,314
Cupola	2,453	5,323,049	6,143,958	11,467,007	5,280,957
Air	122	882,490	498,485	1,380,975	368,003
Brackelsberg	2				
Crucible	12	585	744	1,329	1,013
Puddling	3	224	4,578	4,802	14,979
Blast	74	1,449,910	1,481,598	2,931,508	------------
Direct castings	34	------------	------------	------------	2,183,572
Ferro-alloy	18	9,818	342,108	351,926	------------
Miscellaneous	120	64,038	1,182,190	1,246,228	95
Total	3,314	32,419,643	32,544,232	64,963,875	60,026,404
1949					
Open-hearth	127	20,653,122	14,869,332	35,522,454	41,782,506
Bessemer	28	171,885	37,281	209,166	4,612,408
Electric	318	1,850,205	2,846,389	4,696,594	107,589
Cupola	2,366	4,348,890	4,408,565	8,757,455	4,764,003
Air	120	591,060	309,665	900,725	273,514
Brackelsberg	2				
Crucible	14	602	609	1,211	1,052
Puddling	1	993	1,801	2,794	3,880
Blast	72	1,494,398	1,512,483	3,006,881	------------
Direct castings	33	------------	------------	------------	1,901,780
Ferro-alloy	18	9,756	285,931	295,687	------------
Miscellaneous	101	45,582	899,674	945,256	53
Total	3,200	29,166,493	25,171,730	54,338,223	53,446,765

[1] Where 2 or more separate departments, such as blast furnace, open hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each department is counted as 1 plant.

Consumption of ferrous scrap and pig iron by manufacturers of steel ingots and castings [1] in 1949, by type of furnace, in short tons

Type of furnace or equipment	Scrap			Pig iron
	Home	Purchased	Total	
Open-hearth	20,369,668	14,304,563	34,674,231	41,638,250
Bessemer	163,142	22,689	185,831	4,607,958
Electric	1,357,754	2,264,167	3,621,921	67,342
Cupola	196,832	95,062	291,894	398,651
Air	17,225	11,753	28,978	13,949
Crucible	6	7	13	
Blast [2]	1,494,281	1,512,483	3,006,764	
Direct castings				1,214,463
Miscellaneous	36,639	221,028	257,667	
Total	23,635,547	18,431,752	42,067,299	47,940,613

[1] Includes only those castings made by companies producing steel ingots.
[2] Includes consumption in blast furnaces by both integrated and nonintegrated mills.

Consumption of ferrous scrap and pig iron by manufacturers of steel castings [1] in 1949, by type of furnace, in short tons

Type of furnace or equipment	Scrap			Pig iron
	Home	Purchased	Total	
Open-hearth	269,675	538,147	807,822	140,703
Bessemer	1,293	2,565	3,858	1,590
Electric	310,135	385,156	695,291	12,963
Cupola	122,888	366,548	489,436	136,121
Air Brackelsberg	138,948	92,509	231,457	57,907
Total	842,939	1,384,925	2,227,864	349,284

[1] Excludes companies that produce both steel castings and steel ingots.

Consumption of ferrous scrap and pig iron by iron foundries and miscellaneous users in 1949, by type of furnace, in short tons

Type of furnace or equipment	Scrap			Pig iron
	Home	Purchased	Total	
Open-hearth	13,779	26,622	40,401	3,553
Bessemer	7,450	12,027	19,477	2,860
Electric	182,316	197,066	379,382	27,284
Cupola	4,029,170	3,946,955	7,976,125	4,229,231
Air	434,887	205,403	640,290	201,658
Crucible	596	602	1,198	1,052
Blast	117		117	
Direct castings				687,297
Puddling	993	1,801	2,794	3,880
Ferro-alloy	9,756	285,931	295,687	
Miscellaneous	8,943	678,646	687,589	53
Total	4,688,007	5,355,053	10,043,060	5,156,868

CONSUMPTION BY DISTRICTS AND STATES

During 1949 iron and steel scrap and pig iron were used in all 48 States and the District of Columbia; none was used in Alaska. As in 1948, the largest consuming districts were North Central, Middle Atlantic, and Southeastern. All districts decreased from 1948 in

total scrap and pig iron. The States having the largest consumption of scrap, with the percentage consumed, were: Pennsylvania 23, Ohio 17, Illinois 10, Indiana 10, Michigan-Wisconsin 9, and New York 5.

Consumption of ferrous scrap and pig iron in the United States, 1945–49, by districts

District and year	Active plants reporting [1]	Scrap: Home, Short tons	Scrap: Home, Change from previous year (percent)	Scrap: Purchased, Short tons	Scrap: Purchased, Change from previous year (percent)	Scrap: Total, Short tons	Scrap: Total, Change from previous year (percent)	Pig iron, Short tons	Pig iron, Change from previous year (percent)
New England:									
1945	248	358, 866	−9.4	451, 237	−4.5	810, 103	−6.8	354, 511	−1.5
1946	240	392, 656	+9.4	477, 788	+5.9	870, 444	+7.4	296, 970	−16.2
1947	245	460, 062	+17.2	561, 545	+17.5	1, 021, 607	+17.4	352, 297	+18.6
1948	241	442, 821	−3.7	648, 418	+15.5	1, 091, 239	+6.8	342, 893	−2.7
1949	228	345, 288	−22.0	420, 160	−35.2	765, 448	−29.9	283, 337	−17.4
Middle Atlantic:									
1945	858	10, 401, 507	−16.1	7,434, 229	−6.0	17, 835, 736	−12.2	18, 977, 463	−15.3
1946	818	8, 319, 887	−20.0	6, 614, 440	−11.0	14, 934, 327	−16.3	15, 615, 006	−17.7
1947 [2]	807	10, 100, 971	+21.4	8, 626, 526	+30.4	18, 727, 497	+25.4	20, 566, 893	+31.7
1948	792	10, 564, 402	+4.6	9, 403, 012	+9.0	19, 967, 414	+6.6	20, 990, 519	+2.1
1949	761	9, 023, 788	−14.6	7, 277, 130	−22.6	16, 300, 918	−18.4	17, 804, 856	−15.2
Southeastern:									
1945	485	3, 474, 945	−10.0	2, 731, 033	−1.2	6, 205, 978	−6.3	7, 460, 292	−11.2
1946	476	3, 144, 778	−9.5	2, 547, 664	−6.7	5, 692, 442	−8.3	6, 612, 070	−11.4
1947 [2]	469	3, 639, 590	+15.7	3, 059, 105	+20.1	6, 698, 695	+17.7	8, 216, 999	+24.3
1948	471	3, 946, 494	+8.4	3, 457, 432	+13.0	7, 403, 926	+10.5	9, 063, 195	+10.3
1949	455	3, 770, 512	−4.5	2, 759, 510	−20.2	6, 530, 022	−11.8	8, 658, 653	−4.5
Southwestern:									
1945	131	204, 882	+6.1	378, 618	+6.2	583, 500	+6.2	182, 441	+14.8
1946	121	139, 038	−32.1	402, 683	+6.4	541, 721	−7.2	59, 758	−67.2
1947	123	214, 063	+54.0	532, 740	+32.3	746, 803	+37.9	125, 857	+110.6
1948	120	233, 904	+9.3	573, 557	+7.7	807, 461	+8.1	237, 972	+89.1
1949	115	196, 586	−16.0	488, 576	−14.8	685, 162	−15.1	204, 333	−14.1
North Central:									
1945	1, 380	15, 237, 692	−11.8	12, 352, 904	+.6	27, 590, 596	−6.7	24, 633, 439	−11.7
1946	1, 357	13, 053, 967	−14.3	11, 515, 917	−6.8	24, 569, 884	−10.9	21, 169, 706	−14.1
1947 [2]	1, 356	15, 553, 560	+19.1	14, 258, 421	+23.8	29, 811, 981	+21.3	26, 643, 575	+25.9
1948	1, 340	15, 708, 820	+1.0	15, 891, 047	+11.5	31, 599, 867	+6.0	27, 160, 420	+1.9
1949	1, 305	14, 397, 633	−8.3	12, 211, 219	−23.2	26, 608, 852	−15.8	24, 440, 836	−10.0
Rocky Mountain:									
1945	91	612, 360	+2.3	592, 431	−14.3	1, 204, 791	−6.6	1, 067, 660	−1.4
1946	90	496, 260	−19.0	428, 171	−27.7	924, 431	−23.3	764, 037	−28.4
1947	88	764, 317	+54.0	498, 052	+16.3	1, 262, 369	+36.6	1, 515, 960	+98.4
1948	85	753, 167	−1.5	583, 453	+17.1	1, 336, 620	+5.9	1, 585, 327	+4.6
1949	81	676, 327	−10.2	548, 626	−6.0	1, 224, 953	−8.4	1, 365, 795	−13.8
Pacific Coast:									
1945	300	670, 452	−3.8	1, 289, 929	−11.0	1, 960, 381	−8.7	511, 371	−20.1
1946	279	587, 577	−12.4	1, 363, 285	+5.7	1, 950, 862	−.5	554, 083	+8.4
1947 [2]	270	671, 750	+14.3	1, 724, 540	+26.5	2, 396, 290	+22.8	652, 976	+17.8
1948	265	770, 035	+14.6	1, 987, 313	+15.2	2, 757, 348	+15.1	646, 078	−1.1
1949	255	756, 359	−1.8	1, 466, 509	−26.2	2, 222, 868	−19.4	688, 955	+6.6
Undistributed: [2]									
1947	7	174, 629	-------	24, 490	-------	199, 119	-------	216, 198	-------
United States:									
1945	3, 493	30, 960, 704	−12.6	25, 230, 381	−2.7	56, 191, 085	−8.4	53, 187, 177	−12.7
1946	3, 381	26, 134, 163	−15.6	23, 349, 948	−7.5	49, 484, 111	−11.9	45, 071, 630	−15.3
1947	3, 365	31, 578, 942	+20.8	29, 285, 419	+25.4	60, 864, 361	+23.0	58, 290, 755	+29.3
1948	3, 314	32, 419, 643	+2.7	32, 544, 232	+11.1	64, 963, 875	+6.7	60, 026, 404	+3.0
1949	3, 200	29, 166, 493	−10.0	25, 171, 730	−23.7	54, 338, 223	−16.4	53, 446, 765	−11.0

[1] Where 2 or more separate departments, such as blast furnace, open-hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each department is counted as 1 plant.

[2] In 1947, some scrap and pig iron consumed in Middle Atlantic, Southeastern, North Central, and Pacific Coast districts—not separable—are included with "Undistributed."

Consumption of ferrous scrap and pig iron in the United States in 1949, by States and districts

State and district	Active plants reporting[1]	Scrap: Home, Short tons	Scrap: Home, Percent of total	Scrap: Purchased, Short tons	Scrap: Purchased, Percent of total	Scrap: Total, Short tons	Scrap: Total, Percent of total	Pig iron: Short tons	Pig iron: Percent of total
Connecticut	61	87,881	0.3	141,927	0.6	229,808	0.4	56,835	0.1
Maine	19	11,095	.1	8,484	(2)	19,579	.1	10,304	(2)
Massachusetts	107	202,996	.7	214,510	.9	417,506	.8	174,401	.3
New Hampshire	16	6,313	(2)	8,317	(2)	14,630	(2)	3,252	(2)
Rhode Island	12	31,673	.1	39,234	.2	70,907	.1	32,217	.1
Vermont	13	5,330	(2)	7,688	(2)	13,018	(2)	6,328	(2)
Total New England	228	345,288	1.2	420,160	1.7	765,448	1.4	283,337	.5
Delaware	8	330,051	1.1	514,525	2.1	844,576	1.6	317,516	.6
New Jersey	100								
New York	204	1,362,859	4.7	1,365,660	5.4	2,728,519	5.0	2,652,854	5.0
Pennsylvania	449	7,330,878	25.1	5,396,945	21.4	12,727,823	23.4	14,834,486	27.7
Total Middle Atlantic	761	9,023,788	30.9	7,277,130	28.9	16,300,918	30.0	17,804,856	33.3
Alabama	92	1,330,505	4.6	751,848	3.0	2,082,353	3.8	3,152,311	5.9
District of Columbia	2								
Kentucky	26	1,629,717	5.6	779,648	3.1	2,409,365	4.4	3,593,087	6.7
Maryland	27								
Florida	17	56,777	.2	135,101	.5	191,878	.4	70,171	.2
Georgia	60								
Mississippi	11	1,749	(2)	1,602	(2)	3,351	(2)	1,293	(2)
North Carolina	48	19,325	.1	18,869	.1	38,194	.1	20,958	(2)
South Carolina	21	5,907	(2)	13,931	.1	19,838	(2)	7,360	(2)
Tennessee	60	185,765	.6	232,662	.9	418,427	.8	213,323	.4
Virginia	60								
West Virginia	31	540,767	1.8	825,849	3.3	1,366,616	2.5	1,600,150	3.0
Total Southeastern	455	3,770,512	12.9	2,759,510	11.0	6,530,022	12.0	8,658,653	16.2
Arkansas	10								
Louisiana	24	20,415	.1	71,910	.3	92,325	.2	6,015	(2)
Oklahoma	17								
Texas	64	176,171	.6	416,666	1.6	592,837	1.1	198,318	.4
Total Southwestern	115	196,586	.7	488,576	1.9	685,162	1.3	204,333	.4
Illinois	236	2,642,262	9.1	2,967,362	11.8	5,609,624	10.3	4,498,693	8.4
Indiana	149	3,485,364	12.0	1,773,970	7.0	5,259,334	9.7	6,303,356	11.8
Iowa	56	189,025	.7	249,538	1.0	438,563	.8	107,353	.2
Kansas	32	32,198	.1	65,648	.3	97,846	.2	16,624	(2)
Nebraska	14								
Michigan	187	2,576,231	8.8	2,057,779	8.2	4,634,010	8.5	2,932,925	5.5
Wisconsin	133								
Minnesota	65	209,859	.7	279,783	1.1	489,642	.9	383,691	.7
Missouri	66	143,593	.5	580,006	2.3	723,599	1.4	63,524	.1
North Dakota	3	1,472	(2)	929	(2)	2,401	(2)	261	(2)
South Dakota	2								
Ohio	362	5,117,629	17.5	4,236,204	16.8	9,353,833	17.2	10,134,409	19.0
Total North Central	1,305	14,397,633	49.4	12,211,219	48.5	26,608,852	49.0	24,440,836	45.7
Arizona	8								
Nevada	3	2,871	(2)	57,719	.2	60,590	.1	1,194	(2)
New Mexico	2								
Colorado	25	666,799	2.3	468,945	1.9	1,135,744	2.1	1,364,097	2.6
Utah	26								
Idaho	6	553	(2)	4,692	(2)	5,245	(2)	194	(2)
Montana	9	6,099	(2)	17,263	.1	23,362	(2)	305	(2)
Wyoming	2	5	(2)	7	(2)	12	(2)	5	(2)
Total Rocky Mountain	81	676,327	2.3	548,626	2.2	1,224,953	2.2	1,365,795	2.6
California	150	676,333	2.3	1,145,732	4.5	1,822,065	3.4	673,613	1.3
Oregon	44	80,026	.3	320,777	1.3	400,803	.7	15,342	(2)
Washington	61								
Total Pacific Coast	255	756,359	2.6	1,466,509	5.8	2,222,868	4.1	688,955	1.3
Total United States:									
1949	[1] 3,200	29,166,493	100.0	25,171,730	100.0	54,338,223	100.0	53,446,765	100.0
1948	[1] 3,314	32,419,643	100.0	32,544,232	100.0	64,963,875	100.0	60,026,404	100.0

[1] Where 2 or more separate departments, such as blast furnace, open hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each department is counted as 1 plant.
[2] Less than 0.05 percent.

CONSUMPTION BY TYPE OF FURNACE

Open-Hearth Furnaces.—Ferrous scrap and pig-iron consumption in open-hearth furnaces in 1949 totaled 77,304,960 short tons, a decrease of 12 percent from 1948. Regardless of the decrease from 1948, a record year, the use of ferrous scrap and pig iron consumed in open-hearth furnaces in 1949 exceeded the quantity in any other peacetime year for which the Bureau of Mines has collected these data. The use of home scrap decreased 7 percent, purchased scrap 20 percent, total scrap 13 percent, and pig iron 12 percent. The open-hearth furnace melt in 1949 consisted of 46 percent scrap and 54 percent pig iron, unchanged from 1948. Of the total scrap consumed, 42 percent was purchased compared with 46 percent in 1948 and 45 percent in 1947.

Consumption of ferrous scrap and pig iron in open-hearth furnaces in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total	Pig iron
New England:					
Connecticut	1				
Massachusetts	2	103,716	180,893	284,609	94,085
Rhode Island	1				
Total: 1949	4	103,716	180,893	284,609	94,085
1948	4	77,358	245,093	322,451	102,403
Middle Atlantic:					
Delaware	1				
New Jersey	2	1,222,467	1,004,910	2,227,377	2,462,831
New York	8				
Pennsylvania	44	5,771,225	3,996,761	9,767,986	12,217,677
Total: 1949	55	6,993,692	5,001,671	11,995,363	14,680,508
1948	55	8,058,131	6,232,464	14,290,595	17,269,252
Southeastern and Southwestern:					
Alabama	2				
Georgia	1	985,693	647,339	1,633,032	2,588,878
Tennessee	1				
Texas	1				
Kentucky	2				
Maryland	1	1,874,966	1,303,234	3,178,200	4,369,304
Oklahoma	1				
West Virginia	2				
Total: 1949	11	2,860,659	1,950,573	4,811,232	6,958,182
1948	11	2,830,514	2,288,174	5,118,688	7,344,363
North Central:					
Illinois	10	1,666,838	1,576,827	3,243,665	3,204,565
Indiana	6	3,019,099	1,337,182	4,356,281	5,738,017
Michigan	3	835,015	515,570	1,350,585	1,649,369
Minnesota	1				
Missouri	2	234,941	595,973	830,914	371,084
Wisconsin	2				
Ohio	23	3,805,088	2,428,560	6,233,648	7,237,453
Total: 1949	47	9,560,981	6,454,112	16,015,093	18,201,488
1948	47	9,986,117	8,266,227	18,252,344	20,534,000
Rocky Mountain and Pacific Coast:					
California	7				
Colorado	1	1,134,074	1,282,083	2,416,157	1,848,243
Utah	1				
Washington	1				
Total: 1949	10	1,134,074	1,282,083	2,416,157	1,848,243
1948	9	1,155,497	1,483,572	2,639,069	2,017,316
Total United States: 1949	127	20,653,122	14,869,332	35,522,454	41,782,506
1948	126	22,107,617	18,515,530	40,623,147	47,267,334

Pennsylvania again led in the use of scrap in the open-hearth in 1949, followed in order by Ohio, Indiana, and Illinois; this rank has remained unchanged since 1936. In 1935, the first year data were compiled on iron and steel scrap, Ohio consumed the largest quantity, followed by Pennsylvania, Indiana, and Illinois.

Bessemer Converters.—The 4,821,574 short tons of ferrous raw materials used in Bessemer converters in 1949 represent a 4-percent decrease from the 1948 use of these materials. The proportion of scrap in the metal charges was 1: 23, and of the scrap used 82 percent was home scrap.

Following the usual pattern, Pennsylvania was the principal consumer of converter scrap in 1949.

Consumption of ferrous scrap and pig iron in Bessemer converters in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England and Middle Atlantic:					
Connecticut	1	1,637	1,689	3,326	458
Delaware	2				
Pennsylvania	9	86,234	19,971	106,205	1,374,442
Total: 1949	12	87,871	21,660	109,531	1,374,900
1948	13	106,844	32,013	138,857	1,592,372
Southeastern and Southwestern:					
Alabama	1				
Louisiana	1				
Maryland	1	22,879	9,494	32,373	631,002
Texas	1				
West Virginia	1				
Total: 1949	5	22,879	9,494	32,373	631,002
1948	5	22,499	10,688	33,187	526,123
North Central and Pacific Coast:					
Illinois	2	2,593	989	3,582	373,405
Indiana	1				
Michigan	1				
Minnesota	1	7,918	5,138	13,056	279,208
Missouri	1				
Washington	1				
Ohio	4	50,624	-	50,624	1,953,893
Total: 1949	11	61,135	6,127	67,262	2,606,506
1948	12	68,547	10,859	79,406	2,659,642
Total United States: 1949	28	171,885	37,281	209,166	4,612,408
1948	30	197,890	53,560	251,450	4,778,137

Electric Steel Furnaces.—The melt of ferrous scrap and pig iron used in electric furnaces in 1949 totaled 4,804,183 short tons, a 30-percent decrease from the 6,837,817 tons used in 1948. Decreases in the use of scrap occurred in all districts; pig iron decreased in all except the Rocky Mountain, Southeastern, and Southwestern. This over-all decrease in electric furnace consumption resulted from strikes in the steel and allied industries.

Consumption of ferrous scrap and pig iron in electric steel furnaces in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total	Pig iron
New England:					
Connecticut	4	4,894	3,925	8,819	258
New Hampshire	1				
Massachusetts	8	10,078	7,768	17,846	155
Total: 1949	13	14,972	11,693	26,665	413
1948	14	23,862	18,901	42,763	513
Middle Atlantic:					
Delaware	1	9,847	15,721	25,568	1,006
New Jersey	11				
New York	15	42,331	57,506	99,837	4,936
Pennsylvania	58	522,793	569,443	1,092,236	11,968
Total: 1949	85	574,971	642,670	1,217,641	17,910
1948	86	697,880	952,902	1,650,782	22,244
Southeastern:					
District of Columbia	1	16,311	79,280	95,591	3,044
Kentucky	2				
Maryland	3				
West Virginia	1				
Alabama	6	14,087	42,308	56,395	453
Florida	1				
Georgia	3				
North Carolina	1	11,588	12,403	23,991	818
South Carolina	1				
Tennessee	4				
Virginia	4				
Total: 1949	27	41,986	133,991	175,977	4,315
1948	25	54,522	156,713	211,235	3,820
Southwestern:					
Arkansas	1	27,938	25,110	53,048	1,309
Louisiana	4				
Oklahoma	1				
Texas	8				
Total: 1949	14	27,938	25,110	53,048	1,309
1948	14	39,644	42,680	82,324	1,001
North Central:					
Illinois	26	328,309	562,726	891,035	24,450
Indiana	11	34,074	40,890	74,964	561
Iowa	1	11,166	16,927	28,093	110
Kansas	1				
Nebraska	1				
Michigan	22	152,140	285,629	437,769	6,460
Minnesota	4	5,910	6,316	12,226	105
Missouri	8	9,467	12,151	21,618	1,367
Ohio	33	471,299	782,096	1,253,395	43,328
Wisconsin	13	54,712	59,142	113,854	4,772
Total: 1949	120	1,067,077	1,765,877	2,832,954	81,153
1948	122	1,412,312	2,680,808	4,093,120	101,707
Rocky Mountain:					
Arizona	1	5,133	8,199	13,332	285
Colorado	3				
Nevada	1				
Utah	1				
Total: 1949	6	5,133	8,199	13,332	285
1948	6	9,263	17,361	26,624	268
Pacific Coast:					
California	27	89,073	147,931	237,004	1,853
Oregon	8	16,463	66,175	82,638	123
Washington	18	12,592	44,743	57,335	228
Total: 1949	53	118,128	258,849	376,977	2,204
1948	53	146,539	452,116	598,655	2,761
Total United States: 1949	318	1,850,205	2,846,389	4,696,594	107,589
1948	320	2,384,022	4,321,481	6,705,503	132,314

Cupolas.—Preliminary figures released by the Bureau of the Census, United States Department of Commerce, indicate that shipments of gray-iron castings in 1949 decreased approximately 18 percent from 1948. Accordingly, requirements for scrap and pig-iron cupola consumption decreased in 1949. Cupola furnaces used 13,521,458 short tons of scrap and pig iron, a 19-percent decrease from the 16,747,964 tons used in 1948. The use of home scrap decreased 18 percent, purchased scrap 28 percent, and total scrap 24 percent; pig iron decreased 10 percent.

Charges to cupolas consisted of 32 percent home scrap, 33 percent purchased scrap, and 35 percent pig iron compared with 32, 37, and 31 percent, respectively, in 1948.

As in 1948, Michigan continued to be the largest consumer of cupola scrap, followed in order by Ohio, Illinois, Pennsylvania, Alabama, Indiana, Wisconsin, New York, and New Jersey.

Consumption of ferrous scrap and pig iron in cupola furnaces in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	47	45,399	73,362	118,761	46,690
Maine	19	11,095	8,484	19,579	10,304
Massachusetts	90	109,135	85,423	194,558	96,802
New Hampshire	14	3,862	7,613	11,475	2,386
Rhode Island	10	16,653	11,123	27,776	12,724
Vermont	13	5,330	7,688	13,018	6,328
Total: 1949	193	191,474	193,693	385,167	175,234
1948	203	288,052	330,955	619,007	218,127
Middle Atlantic:					
Delaware	3	849	2,259	3,108	1,591
New Jersey	74	149,732	217,524	367,256	209,881
New York	146	202,055	196,467	398,522	205,853
Pennsylvania	270	300,699	325,382	626,081	388,927
Total: 1949	493	653,335	741,632	1,394,967	806,252
1948	509	913,352	1,097,538	2,010,890	1,023,126
Southeastern:					
Alabama	74	270,724	307,168	577,892	771,568
Maryland	20	32,153	36,997	69,150	42,212
Florida	16	1,393	3,534	4,927	921
Georgia	54	16,324	21,054	37,378	27.122
Kentucky	20	38,216	16,184	54,400	112,417
Mississippi	11	1,749	1,602	3,351	1,293
North Carolina	47	18,502	18,842	37,344	20,868
South Carolina	19	5,895	4,454	10,349	7,355
Tennessee	53	125,053	107,492	232,545	150,672
Virginia	53	49,336	91,450	140,786	61,756
West Virginia	19	7,337	11,765	19,102	5,553
Total: 1949	386	566,682	620,542	1,187,224	1,201,737
1948	400	750,794	924,461	1,675,255	1,334,976

Consumption of ferrous scrap and pig iron in cupola furnaces in the United States in 1949, by districts and States, in short tons—Continued

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
Southwestern:					
Arkansas	9	520	1,826	2,346	503
Louisiana	18	2,256	5,572	7,828	813
Oklahoma	14	4,272	8,021	12,293	2,336
Texas	48	30,640	77,833	108,473	29,719
Total: 1949	89	37,688	93,252	130,940	33,371
1948	94	48,664	131,152	179,816	35,178
North Central:					
Illinois	165	463,419	367,922	831,341	327,924
Indiana	114	253,036	223,090	476,126	251,135
Iowa	53	173,858	123,289	297,147	104,240
Kansas	30	18,572	43,112	61,684	13,603
Michigan	152	1,032,193	842,924	1,875,117	1,014,259
Minnesota	53	48,660	88,906	137,566	40,118
Missouri	49	54,859	102,351	157,210	36,626
Nebraska	12	4,930	8,039	12,969	2,822
North Dakota	3	1,472	929	2,401	261
South Dakota	2				
Ohio	241	411,495	433,994	845,489	433,075
Wisconsin	103	275,543	190,650	466,193	208,195
Total: 1949	977	2,738,037	2,425,206	5,163,243	2,432,258
1948	1,008	3,128,182	3,237,896	6,366,078	2,529,769
Rocky Mountain:					
Arizona	4	845	28,012	28,857	1,000
Colorado	18	16,678	40,504	57,182	24,957
Idaho	5	528	2,570	3,098	194
Montana	6	5,709	4,236	9,945	252
New Mexico	2	338	5,871	6,209	158
Utah	15	46,440	35,958	82,398	34,829
Wyoming	2	5	7	12	5
Total: 1949	52	70,543	117,158	187,701	61,395
1948	54	79,443	127,220	206,663	73,289
Pacific Coast:					
California	104	73,861	157,602	231,463	45,314
Oregon	35	8,114	24,969	33,083	4,786
Washington	37	9,156	34,511	43,667	3,656
Total: 1949	176	91,131	217,082	308,213	53,756
1948	185	114,562	294,736	409,298	66,492
Total United States: 1949	2,366	4,348,890	4,408,565	8,757,455	4,764,003
1948	2,453	5,323,049	6,143,958	11,467,007	5,280,957

Air Furnaces.—Scrap and pig iron consumed in air furnaces (including two Brackelsberg) in 1949 amounted to 1,174,239 short tons, a decrease of 33 percent from the 1,748,978 tons melted in these furnaces in 1948. The use of home scrap decreased 33 percent and of purchased scrap 38 percent; pig iron decreased 26 percent.

Ohio led in the use of scrap in air furnaces, followed in order by Illinois, Pennsylvania, Indiana, Wisconsin, Michigan, and New York.

Consumption of ferrous scrap and pig iron in air furnaces [1] in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total	Pig iron
New England:					
Connecticut	6				
Massachusetts	4	27,728	7,734	35,462	13,060
New Hampshire	1				
Rhode Island	1				
Total: 1949	12	27,728	7,734	35,462	13,060
1948	13	47,578	20,416	67,994	21,445
Middle Atlantic:					
Delaware	1	6,787	1,260	8,047	4,438
New Jersey	2				
New York	10	29,507	13,519	43,026	13,924
Pennsylvania	21	65,850	44,553	110,403	47,465
Total: 1949	34	102,144	59,332	161,476	65,827
1948	35	188,694	110,596	299,290	87,305
Southeastern and Southwestern:					
Texas	1	11,325	6,830	18,155	5,801
West Virginia	2				
Total: 1949	3	11,325	6,830	18,155	5,801
1948	4	17,943	12,629	30,572	7,138
North Central:					
Illinois	14	177,181	85,968	263,149	80,872
Indiana	10				
Michigan	6	53,405	30,880	84,285	17,961
Iowa	1				
Kansas	1	9,285	2,863	12,148	7,809
Minnesota	1				
Missouri	1				
Ohio	22	152,471	82,000	234,471	55,219
Wisconsin	12	54,303	33,253	87,556	23,730
Total: 1949	68	446,645	234,964	681,609	185,591
1948	67	625,470	353,651	979,121	249,199
Rocky Mountain and Pacific Coast:					
California	4	3,218	805	4,023	3,235
Colorado	1				
Total: 1949	5	3,218	805	4,023	3,235
1948	5	2,805	1,193	3,998	2,916
Total United States: 1949	122	591,060	309,665	900,725	273,514
1948	124	882,490	498,485	1,380,975	368,003

[1] Includes 2 Brackelsberg furnaces, 1 each in Indiana and Ohio.

Crucible and Puddling Furnaces.—Crucible furnaces used 1,211 short tons of scrap and 1,052 tons of pig iron in 1949 compared with 1,329 and 1,013 tons, respectively, in 1948. Puddling furnaces used 6,674 tons of scrap and pig iron. Of the total puddling-furnace melt in 1949, 2,794 tons were scrap compared with 4,802 tons during the previous year. All of the scrap and pig iron consumed in puddling furnaces was in Pennsylvania.

Consumption of ferrous scrap and pig iron in crucible and puddling furnaces in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	1	305	436	741	411
Massachusetts	1				
Total: 1949	2	305	436	741	411
1948	2	295	618	913	254
Middle Atlantic and Southeastern:					
District of Columbia	1	208	111	319	410
New York	2				
Virginia	1				
Pennsylvania	4	1,029	1,817	2,846	3,885
Total: 1949	8	1,237	1,928	3,165	4,295
1948	8	364	4,608	4,972	15,136
North Central:					
Ohio	2	(1)	(1)	(1)	(1)
Wisconsin	1				
Total: 1949	3	(1)	(1)	(1)	(1)
1948	2				
Southwestern and Pacific Coast:					
California	1	(1)	(1)	(1)	(1)
Oklahoma	1				
Total: 1949	2	(1)	(1)	(1)	(1)
1948	3				
Total United States: 1949	15	1,595	2,410	4,005	4,932
1948	15	809	5,322	6,131	15,992

[1] Included with total for United States.

Blast Furnaces.—Materials other than scrap constitute by far the largest proportion of the blast-furnace charge and in 1949 consisted of 97,048,525 short tons of iron ore, sinter, and manganiferous ore; 2,981,178 tons of mill cinder and roll scale; 3,353,665 tons of open-hearth and Bessemer slag; and 27,655 tons of miscellaneous materials.

Total consumption of scrap in 1949 by 72 plants operating blast furnaces was 3,006,881 short tons, a 3-percent increase over 1948. The scrap charged to blast furnaces was 50 percent home and 50 percent purchased, compared with 49 and 51 percent, respectively, in 1948 and 52 and 48 percent, respectively, in 1947. The proportion of scrap used to pig iron produced was 5.6 percent compared with 4.9 percent in 1948; home scrap 2.8 percent and purchased scrap 2.8 percent in 1949.

Consumption of ferrous scrap in blast furnaces in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap		
		Home	Purchased	Total
New England and Middle Atlantic:				
Massachusetts	1	31,047	126,147	157,194
New York	6			
Pennsylvania	17	562,132	366,462	928,594
Total: 1949	24	593,179	492,609	1,085,788
1948	24	565,151	539,592	1,104,743
Southeastern and Southwestern:				
Alabama	5	198,535	93,934	292,469
Kentucky	1	195,686	115,536	311,222
Maryland	1			
Texas	3			
West Virginia	2			
Total: 1949	12	394,221	209,470	603,691
1948	14	413,813	208,634	622,447
North Central:				
Illinois	6	81,626	175,207	256,833
Indiana	3	83,418	134,083	217,501
Michigan	2	108,230	66,694	174,924
Minnesota	2			
Ohio	21	225,144	434,124	659,268
Total: 1949	34	498,418	810,108	1,308,526
1948	34	458,694	733,096	1,191,790
Rocky Mountain:				
Colorado	1	8,580	296	8,876
Utah	1			
Total: 1949	2	8,580	296	8,876
1948	2	12,252	276	12,528
Total United States: 1949	72	1,494,398	1,512,483	3,006,881
1948	74	1,449,910	1,481,598	2,931,508

USE OF SCRAP IN FERRO-ALLOY PRODUCTION

The producers of ferro-alloys (by other than blast furnaces) in 1949 consumed 295-687 short tons of scrap, a 16-percent decrease from 1948. Of this total, 172 tons were used in the aluminothermic process and the balance in electric furnaces. Scrap used in blast furnaces in the manufacture of ferro-alloys is included in this chapter with blast furnaces. Purchased scrap accounted for 97 percent of the quantity used and home scrap 3 percent; in 1948 the percentages were the same.

Eighteen ferro-alloy plants used ferrous scrap in 1949, the same as in 1948. Of these plants, 17 operated electric furnaces. One of this group employed both the electric and aluminothermic process, and one additional plant used the aluminothermic process only.

Consumption of ferrous scrap by ferro-alloy producers in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total
Middle Atlantic:				
New York	5	117	58,298	58,415
Pennsylvania	2		355	355
Total: 1949	7	117	58,653	58,770
1948	8	254	82,266	82,520
North Central:				
Iowa	1	9,639	132,644	142,283
Ohio	3			
Total: 1949	4	9,639	132,644	142,283
1948	4	9,564	142,577	152,141
Southeastern:				
Alabama	1		84,707	84,707
Kentucky	1			
South Carolina	1			
Tennessee	1			
West Virginia	1			
Total: 1949	5		84,707	84,707
1948	4		109,244	109,244
Pacific Coast:				
Oregon	1		9,927	9,927
Washington	1			
Total: 1949	2		9,927	9,927
1948	2		8,021	8,021
Total United States: 1949	18	9,756	285,931	295,687
1948	18	9,818	342,108	351,926

MISCELLANEOUS USES

Scrap consumed in 1949 for miscellaneous purposes, such as rerolling, nonferrous metallurgy, and as a chemical agent, remained at slightly less than 2 percent of the total consumption. This percentage has been unchanged for the past 5 years. The quantity so used—945,256 short tons—was a decrease of 24 percent from that used for these purposes in 1948. Of the quantity used, 95 percent was purchased and 5 percent home scrap.

Consumption of ferrous scrap in miscellaneous uses in the United States in 1949, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total
New England:				
Connecticut	1	665	12,271	12,936
Massachusetts	1			
Total: 1949	2	665	12,271	12,936
1948	3	625	14,253	14,878
Middle Atlantic:				
New Jersey	11	2,690	95,823	98,513
New York	9	263	101,391	101,654
Pennsylvania	13	20,916	72,201	93,117
Total: 1949	33	23,869	270,415	294,284
1948	45	39,118	376,313	[illegible]

Consumption of ferrous scrap in miscellaneous uses in the United States in 1949, by districts and States, in short tons—Continued

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total
Southeastern:				
Alabama	3	121	39,407	39,528
Georgia	2	1,250	968	2,218
Tennessee	1			
Maryland	1	558	66,195	66,753
Virginia	2			
West Virginia	1			
Total: 1949	10	1,929	106,570	108,499
1948	10	1,123	135,532	136,655
Southwestern:				
Louisiana	1	1,592	7,547	9,139
Texas	2			
Total: 1949	3	1,592	7,547	9,139
1948	3	547	9,984	10,531
North Central:				
Illinois	9	835	228,750	229,585
Indiana	3	12,211	7,698	19,909
Michigan	1	1,217	20,128	21,345
Nebraska	1			
Wisconsin	2			
Minnesota	2	114	421	535
Missouri	5	----------	59,636	59,636
Ohio	5	1,385	65,561	66,946
Total: 1949	28	15,762	382,194	397,956
1948	31	19,951	465,943	485,894
Rocky Mountain:				
Arizona	3	----------	22,685	22,685
Nevada	2			
Colorado	1	415	18,289	18,704
Idaho	1			
Montana [1]	3			
Utah	6	998	24,707	25,705
Total: 1949	16	1,413	65,681	67,094
1948	18	2,139	96,114	98,253
Pacific Coast:				
California	6	305	53,152	53,457
Washington	3	47	1,844	1,891
Total: 1949	9	352	54,996	55,348
1948	10	535	90,051	90,586
Total United States: 1949	101	45,582	899,674	945,256
1948	120	64,038	1,182,190	1,246,228

[1] In addition, 53 tons of pig iron were consumed in miscellaneous uses in Montana during 1949.

STOCKS

Complete iron- and steel-scrap stock figures covering 1949 year-end stocks are not available; producers (railroads and manufacturers) were not canvassed. Dealers and automobile wreckers reporting to the Bureau of Mines had 324,387 short tons of material on hand December 31, 1949, compared with 193,108 short tons at the end of 1948, an increase of 131,279 or 68 percent. Shipbreakers reported 97,886 short tons of material on hand December 31, 1949.

Consumers' Stocks.—Consumers' stocks of home and purchased iron and steel scrap on December 31, 1949, totaled 5,640,859 short tons—a decrease of 817,277 short tons or 13 percent from the beginning of the year. Stocks of home scrap (1,564,054 tons) decreased 2 percent and purchased scrap (4,076,805 tons) decreased 16 percent. Stocks of pig iron on December 31, 1949, amounted to 1,657,634 short tons, an increase of 3 percent over the 1,606,160 short tons on hand December 31, 1948.

Consumers' stocks of ferrous scrap and pig iron on hand in the United States on Dec. 31, 1948, and Dec. 31, 1949, by States and districts, in short tons

State and district	Dec. 31, 1948				Dec. 31, 1949			
	Scrap			Pig iron	Scrap			Pig iron
	Home	Purchased	Total		Home	Purchased	Total	
Connecticut	5,163	16,076	21,239	15,714	7,673	21,598	29,271	10,904
Maine	2,764	5,300	8,064	4,939	2,493	3,979	6,472	2,596
Massachusetts	37,545	47,738	85,283	53,212	30,591	56,028	86,619	113,657
New Hampshire	678	4,397	5,075	1,606	219	2,741	2,960	681
Rhode Island	775	9,281	10,056	4,559	1,198	3,704	4,902	6,231
Vermont	493	5,278	5,771	1,417	135	3,668	3,803	771
Total New England	47,418	88,070	135,488	81,447	42,309	91,718	134,027	134,840
Delaware }	16,019	87,331	103,350	37,487	14,061	73,298	87,359	54,091
New Jersey }								
New York	47,644	266,799	314,443	53,111	52,158	226,691	278,849	173,310
Pennsylvania	452,341	959,736	1,412,077	268,378	459,012	845,455	1,304,467	318,544
Total Middle Atlantic	516,004	1,313,866	1,829,870	358,976	525,231	1,145,444	1,670,675	545,945
Alabama	30,863	114,348	145,211	89,626	66,554	100,837	167,391	105,043
District of Columbia }								
Kentucky }	46,480	103,141	149,621	64,596	62,725	77,119	139,844	33,379
Maryland }								
Florida }	1,501	10,496	11,997	5,911	1,280	15,657	16,937	3,475
Georgia }								
Mississippi	172	655	827	385	231	603	834	358
North Carolina	282	2,881	3,163	2,008	372	2,085	2,457	2,288
South Carolina	201	2,520	2,721	2,479	70	3,240	3,310	2,211
Tennessee }	9,719	51,158	60,877	24,350	12,536	37,423	49,959	43,905
Virginia }								
West Virginia	5,046	91,519	96,565	25,859	13,330	102,213	115,543	9,468
Total Southeastern	94,264	376,718	470,982	215,214	157,098	339,177	496,275	200,127
Arkansas }								
Louisiana }	1,067	14,559	15,626	1,271	543	18,414	18,957	805
Oklahoma }								
Texas	119,446	392,086	511,532	215,902	9,164	79,189	88,353	45,668
Total Southwestern	120,513	406,645	527,158	217,173	9,707	97,603	107,310	46,473
Illinois	94,843	714,516	809,359	121,091	134,985	599,563	734,548	104,039
Indiana	214,198	375,903	590,101	82,215	193,033	224,060	417,093	61,096
Iowa	5,737	51,800	57,537	12,231	8,258	37,340	45,598	18,872
Kansas }	589	12,600	13,189	3,461	488	10,491	10,979	2,234
Nebraska }								
Michigan }	145,619	258,060	403,679	184,991	100,668	245,649	346,317	176,642
Wisconsin }								
Minnesota	13,988	136,821	150,809	11,829	12,049	85,132	97,181	23,451
Missouri	4,042	113,160	117,202	16,562	1,849	101,779	103,628	13,116
North Dakota }	282	169	451	59	90	90	180	87
South Dakota }								
Ohio	212,502	670,919	883,421	240,703	277,552	620,186	897,738	203,833
Total North Central	691,800	2,333,948	3,025,748	673,142	728,972	1,924,290	2,653,262	603,369
Arizona }								
Nevada }	2,896	14,260	17,156	367	3,096	6,440	9,536	443
New Mexico }								
Colorado }	10,327	77,007	87,334	10,640	63,903	68,680	132,583	28,884
Utah }								
Idaho		1,857	1,857	36		2,779	2,779	56
Montana	1,765	8,724	10,489	246	1,477	6,088	7,565	198
Wyoming	3	1	4	8	5		5	4
Total Rocky Mountain	14,991	101,849	116,840	11,297	68,481	83,987	152,468	29,585
Alaska }								
Oregon }	3,788	76,111	79,899	5,734	4,257	87,071	91,328	2,949
Washington }								
California	109,895	162,256	272,151	43,177	27,999	307,515	335,514	94,346
Total Pacific Coast	113,683	238,367	352,050	48,911	32,256	394,586	426,842	97,295
Total United States	1,598,673	4,859,463	6,458,136	1,606,160	1,564,054	4,076,805	5,640,859	1,657,634

Suppliers' Stocks.—Stocks of iron and steel scrap in the hands of dealers (317,223 tons) and automobile wreckers (7,164 tons) totaled 324,387 short tons on December 31, 1949, compared with 193,108 tons on December 31, 1948—an increase of 68 percent. Stocks held by shipbreakers amounted to 97,886 short tons on December 31, 1949.

PRICES

The composite price of iron and steel scrap was $41.36 per gross ton during January 1949 but declined to a low of $19.33 per gross ton in July, which was near the level of $19.17 set by the Office of Price Administration during 1942 and 1943. No. 1 Cast scrap at Chicago was selling at $57.25 per gross ton during January 1949, a decrease of $10.75 per ton from January 1948 and $17.05 less than the peak price of $74.30 per gross ton established in August 1948. No. 1 Heavy-Melting steel at Pittsburgh and Chicago was quoted by Iron Age at $41.25 and $40.06, respectively, during January, which was high for the year, but dropped to a low of $20.75 and $19.75 per gross ton during July at Pittsburgh and Chicago, respectively; however, the price showed an upward trend until December when there was a lack of consumer buying and mill rejections. Mills were examining incoming scrap with great care and rejecting supplies deemed not up to the most stringent specifications. This was particularly true of No. 2 bundles.

FOREIGN TRADE [2]

Imports.—Imports of iron and steel scrap, including tin-plate scrap, in 1949 increased nearly two and a half times in quantity (1,140,364 short tons compared with 480,724 tons in 1948) and the same in value ($29,703,389 compared with $12,180,222 in 1948). Of the 1949 imports, 532,850 tons came from Germany, 200,486 tons from the Netherlands, 198,589 tons from Japan, 75,955 tons from the Republic of the Philippines, and the remainder from other countries. There were 45,951 tons of tin-plate scrap imported in 1949 compared with 46,014 tons in 1948, mostly from Canada and Australia.

[2] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Ferrous scrap imported for consumption in the United States, by countries, 1945–49, in short tons

[U. S. Department of Commerce]

Country	1945	1946	1947	1948	1949
Australia	----------	12	3,451	18,168	12,469
Belgium-Luxembourg	----------	----------	----------	7,614	5,731
Canada	48,454	36,422	32,864	34,547	71,199
Canal Zone	----------	----------	1,335	6,957	1,824
Cuba	5,999	4,049	22,687	33,026	10,337
Denmark	----------	----------	----------	5,808	146
French Morocco	----------	----------	----------	3,384	1,682
Germany	----------	----------	----------	227,805	532,850
India	----------	----------	----------	3,694	1,186
Italy	603	1,000	(1)	3,963	16
Japan	----------	----------	----------	65,856	198,589
Netherlands	60	1	----------	9,863	200,486
Netherlands Antilles	3,914	5,573	5,468	5,411	2,128
Philippines	----------	----------	3	25,390	75,955
Union of South Africa	439	----------	351	4,284	4,461
United Kingdom	6	197	1,238	1,251	3,257
Other countries	7,036	10,447	3,284	23,694	18,048
Total: Short tons	66,511	57,701	70,681	480,724	1,140,364
Value	$707,146	$492,506	$1,124,686	$12,180,222	$29,703,389

(1) Less than 1 ton.

Exports.—Exports of ferrous scrap from the United States in 1949 were 298,594 short tons valued at $7,342,886, a 41-percent increase in tonnage over 1948 and a 3-percent increase in value. Imports exceeded exports by 841,770 short tons. The tonnage exported amounted to 9 percent of the 5-year prewar average (for 1935–39) of 3,298,326 tons a year, compared with 6 percent during 1948. The 1949 exports included 3,634 tons of tin-plate circles, strips, cobbles, and terneplate clippings and scrap, valued at $395,370. The same materials in 1948 amounted to 3,948 tons valued at $417,128.

Ferrous scrap exported from the United States, by countries of destination, 1945–49,[1] in short tons

[U. S. Department of Commerce]

Country of destination	1945	1946	1947	1948	1949
Argentina	1,277	1,731	1,681	1,187	3,866
Brazil	335	737	392	602	12
Canada	45,672	82,134	119,223	168,119	162,631
Chile	7,447	1,268	5,401	48	----------
China	----------	6,031	3,645	494	33
Colombia	666	22	206	4	----------
Egypt	----------	----------	----------	----------	315
Hong Kong	----------	393	1,941	1,131	1,558
India	----------	----------	72	866	808
Mexico	25,333	47,927	33,882	39,291	128,624
Netherlands	----------	86	266	----------	----------
Norway	----------	----------	----------	34	4,120
Sweden	----------	16	608	95	----------
Turkey	39	----------	120	----------	508
Union of South Africa	168	396	477	58	25
United Kingdom	----------	435	141	----------	38
Uruguay	729	149	203	----------	----------
Other countries	387	291	2,069	341	1,061
Total: Short tons	82,053	141,613	170,327	212,194	298,594
Value	$1,393,722	$2,736,651	$5,072,847	$7,156,105	$7,342,886

[1] Data for 1945–48 revised to exclude waste-waste tin plate.

Lead

By Richard H. Mote and Edith E. den Hartog

GENERAL SUMMARY

THE TRANSITION in lead supply from insufficiency to abundance accompanied by falling prices highlighted the domestic lead industry in 1949. Noteworthy also was the consumers' cautious buying and general lack of confidence in price stability that resulted in purchases of quantities substantially smaller than actual needs and an 18-percent reduction in consumers' inventories during the year. Some stability was rendered the lead market by the Government through purchase during the year of substantial tonnages of pig lead for the National Stockpile. Contributing to the expanded supply was the high level of imports prevailing in 1949, which resulted in accumulation of nearly 400,000 tons of lead from foreign sources, the largest annual tonnage imported in the peacetime history of the United States.

Although labor strikes continued to exact a toll in reduced output of lead at mines and smelters, the total loss of production was not as great as in 1948. Total mine output advanced 5 percent in 1949, and production of refined lead at primary refineries rose 22 percent to the highest level since 1942. Lead from secondary sources continued for the fourth year to be a greater source of supply than production from domestic mines.

Over-all consumption of primary, antimonial, and secondary lead in the United States in 1949 declined 16 percent from 1948.

Salient statistics of the lead industry in the United States, 1940–44 (average) and 1945–49, in short tons

	1940–44 (average)	1945	1946	1947	1948	1949
Production of refined primary lead:						
From domestic ores and base bullion	434,387	356,535	293,309	381,109	339,413	404,449
From foreign ores and base bullion	86,685	87,050	44,888	59,901	67,281	72,889
Total	521,072	443,585	338,197	441,010	406,694	477,338
Recovery of secondary lead	330,855	363,039	392,787	511,970	500,071	412,183
Imports (general):						
Lead in pigs, bars, and old	253,160	230,313	[1] 118,042	175,538	[1] 276,013	289,889
Lead in base bullion	18,565	8	125	1,580	7,186	2,373
Lead in ores and matte	87,258	70,005	[1] 44,286	50,752	63,907	107,279
Exports of refined pig lead	11,516	[1] 1,408	[1] 598	[1] 1,523	[1] 411	969
Consumption of primary and secondary lead	1,021,329	1,051,602	956,476	1,172,000	1,133,895	957,674
Prices (cents per pound):						
New York:						
Average for period	6.09	6.50	8.11	14.67	18.04	15.36
Quot[illegible] end of period	6.17	6.50	12.55	15.00	21.50	12.00
London average for period	4.49	4.99	8.63	15.27	17.16	16.95
Mine production of recoverable lead	457,046	390,831	335,475	384,221	390,476	409,908
World smelter production of lead	1,743,000	1,233,000	[1] 1,146,000	[1] 1,443,000	[1] 1,488,000	1,723,000

[1] Revised figure.

[1] This report deals primarily with the smelting, refining, and consuming phases of the industry. For details of mining operations, see various State chapters of this volume.

DOMESTIC PRODUCTION

Statistics on lead output may be prepared on a mine or smelter and refinery basis. Mine-production data compiled on the basis of lead content in ore and concentrates and adjusted to account for average losses in smelting are a closer measure of output from year to year and are most accurate for showing the geographic distribution of production. Pig-lead output, as reported by smelters and refiners, presents a more precise figure of actual lead recovery but indicates only in a general way the source of crude material treated. Smelter and refinery output generally differs from the mine figure owing to the lag between mine shipments and smelter consumption of ore and concentrates.

MINE PRODUCTION

Domestic mine output of recoverable lead rose 5 percent in 1949 compared with 1948 and was the largest since 1944. This gain reflected the response to the incentive of high market prices during the early part of the year and also fewer interruptions in operation due to labor-management disputes, such as the labor strike that shut down the large lead mines in Southeastern Missouri for 2½ months in 1948 at an estimated loss of 25,000 tons of lead. A downward trend in lead price which began in March and continued through May resulted in some mine closings and reduced workweeks at most large lead-producing properties but failed to offset completely the net gain in output recorded during the early part of 1949. Except for January, production during the first half of the year was at a rate consistently over the 1,123-ton average daily output for the entire year. Production during the latter half of the year, however, fell sharply, and the daily output through November remained below the annual average. The daily production rate in December was 21 percent above the low point of the year, reached in July, but was only 90 percent of the March rate, which was highest for the year.

Production in 11 of the 22 lead-producing States in 1949 exceeded the rates established in 1948, and in some instances record and near-record high outputs were recorded. In Arizona the production was far greater than in any other year in the State's mining history, and not since 1917 have California mines produced as much lead as was recovered in 1949. Colorado lead output reached the highest point since 1927 and in Nevada the 1949 production was larger than for any year since 1936. Similar but less spectacular records were established in the Mid-Continent region, where Oklahoma lead output exceeded that of every year since 1942; Kansas production hit an 8-year high; and Missouri mines closely approached the 1947 output.

Of the total lead produced at United States mines in 1949, 66 percent came from the output of 25 properties. Missouri continued to rank first among the States in the production of lead, and the Southeastern Missouri district continued to be the largest lead-producing area, supplying 31 percent of the total domestic output. As in the past, the St. Joseph Lead Co., produced the bulk of the output from its Bonne Terre, Desloge, Federal (including Doe Run), and Leadwood mine groups in St. Francois County and the Mine La Motte mine in Madison County. Each mine is equipped with a

mill; the five have a combined daily capacity of about 28,800 tons of ore. The St. Louis Smelting & Refining Division, National Lead Co., operated continuously its Madison lead-copper mine and 1,200-ton all-flotation mill at Fredericktown; the output of both lead and copper concentrates showed a large increase over 1948. The Catherine-Fleming mine was operated by the Park City Consolidated Mines Co. from January to March and by the Fredericktown Lead Co. the remainder of the year. In Jefferson County the Fredericktown Lead Co. operated the leased Valle Mine property during January and February and 1 week in May.

Lead production in the Tri-State district gained despite curtailments in rate of ore output and shut-downs caused by falling metal prices. On March 5 the weekly quoted price of lead concentrates at Joplin, Mo., was $290.92 a ton, and in the slightly more than 2 months that followed the quotation dropped without interruption to $148.63 on May 28. About 50 of the mines shut down, and most of the other 76 curtailed production. Output of lead concentrates in June was 34 percent under March production. During July the market price advanced to $183.91 but the monthly production was the lowest of the year, as the mines and mills of the Eagle-Picher Mining & Smelting Co. were shut down by a work stoppage from July 1 to August 7, and other mines shipping to the company's Central mill could not operate during this period. The five leading Tri-State lead-producing companies in 1949, in order of output, were: Eagle-Picher Mining & Smelting Co., Nellie B. Mining Co., Federal Mining & Smelting Co., National Lead Co. St. Louis Smelting & Refining Division, and the W. M. & W. Mining Co. The Tri-State district produced 8 percent of the total domestic lead output in 1949.

Mine production of recoverable lead in the combined Western States dropped 4 percent from 1948. In 1949 lead mines in the region contributed 59 percent of the total domestic production compared with 65 percent in 1948. Idaho was again the largest producer of lead in the Western States and second only to Missouri in the United States. In 1949, 94 percent of the Idaho total lead came from the Coeur d'Alene region. Six properties in the State produced 64 percent of the total lead, 77 percent of which came from zinc-lead ore and old tailings. Lead production in Utah in 1949 declined 5 percent from the 1948 output. Because of a reduced workweek early in May, followed by stoppages late in June at three of the large lead producers and serious curtailment at the fourth in the Park City region, production of lead for the year declined substantially at the properties of the New Park Mining Co., Park Utah Consolidated Mines Co., Silver King Coalition Mines Co., and Pacific Bridge Co. The Calumet mine in the Rush Valley district also produced less lead than in 1948. These losses were compensated in part by increases in lead yield from the United States & Lark group, Chief Consolidated Mining Co. property, Butterfield group, Cardiff mine, and the Hidden Treasure mine, and the return to production of the New Park Mining Co. property on September 15. The United States & Lark property of the United States Smelting, Refining & Mining Co. in the West Mountain (Bingham) district remained first among the State lead producers. Of the State total lead in 1949, 92 percent was recovered from zinc-lead ore. The output of lead in Arizona in 1949 was far greater than in any

previous year in the State's history. Continuous operations at lead and zinc-lead mines throughout 1949 resulted in a total production of 33,568 tons of recoverable lead, a gain of 3,669 tons over the record output in 1948. The Copper Queen mine of the Phelps Dodge Corp. at Bisbee, with an increase of 23 percent in lead production, remained by far the largest producer of lead in Arizona. Other large producers were the St. Anthony property at Tiger, the San Xavier (Eagle-Picher Mining & Smelting Co.) south of Tucson, the Iron King mine at Humboldt, and the Flux-January-Norton group near Patagonia. More than 92 percent of the lead output in 1949 was recovered from zinc-lead ore and the rest largely from lead ore.

Although the sharp drop in base-metal prices caused some Colorado mines to close in 1949, the State output of lead increased for the third successive year and was the highest since 1927. The five leading producing mines, in order of rank, were the Victory group at Kokomo, Resurrection at Leadville, Treasury Tunnel-Black Bear in San Miguel County, Smuggler Union at Telluride, and Eagle mine at Red Cliff. Zinc-lead ore yielded 65 percent of the State total lead during the year. Lead production in Montana in 1949 declined 2 percent from the 1948 figure. As in most other producing areas, the drop in output was largely the result of declining base-metal prices, which forced closing of some smaller properties and brought about curtailed activity at other operations. At the Butte properties of the Anaconda Copper Mining Co. a 5-day workweek went into effect early in June, underground mining was reduced, shipments of zinc-lead dump ore ceased, and work on the Greater Butte project was temporarily suspended. In mid-November shipments of dump ore were resumed. The four leading lead producers, which supplied 79 percent of the State lead in 1949, were the Butte Hill mine and dumps at Butte, the Emma mine at Butte, the Mike Horse mine at Flesher, and the Jack Waite mine in Sanders County. Lead output from Nevada mines in 1949 surpassed the 1948 production by 9 percent to reach the highest level since 1936. The Pioche district, Lincoln County, accounted for 62 percent of the lead produced in the State in 1949; the leading properties were: The Pioche groups operated by the Combined Metals Reduction Co., the Ely Valley mine worked by Ely Valley Mines, Inc., and the Prince mine of the Prince Consolidated Mining Co. Important producers in addition to those in the Pioche district included the Copper Canyon Mining Co. Copper Canyon mine, Battle Mountain district, Lander County; L. F. Jacobson, Yellow Pine mine, Yellow Pine district, Clark County and McFarland & Hullinger, Cleveland mine, Delano district, Elko County. The California mine production of recoverable lead was 10,318 tons in 1949, a 13-percent gain over 1948 and the highest recorded since the record output in 1917. The Anaconda Copper Mining Co. Darwin group of mines in the Coso district, Inyo County, continued to be the State's leading producer of lead. The property was closed during July, August, and part of September owing to falling base-metal prices in the second quarter of the year. Other important lead mines operated in California in 1949 included Anaconda's Shoshone group, also in the Coso district, the Defense and Minnietta mines in the Modoc district of Inyo County, and the Coronado Copper & Zinc Co. Afterthought mine in the Cow Creek district of Shasta County

Despite a work stoppage most of the year at the Grandview mine of the American Zinc, Lead & Smelting Co. in the Metaline district, normally the State's largest lead producer, lead output in Washington in 1949 was only 10 percent under the 1948 figure. The Bonanza mine in Stevens County and the property of the Pend Oreille Mines & Metals Co. in the Metaline district reported substantial increases in lead yield. Production dropped at the Deep Creek mine in Stevens County. The above four properties supplied 97 percent of the State lead in 1949, and of the total lead 64 percent was derived from zinc-lead ore and nearly all the remainder from lead ore. The mine production of lead in New Mexico, the bulk of which comes from mines yielding chiefly zinc, declined 39 percent from 1948. The larger producers in 1949 were the American Smelting & Refining Co. Ground Hog and United States Smelting, Refining & Mining Co. Bayard groups in the Central district and the Kelly group (American Smelting & Refining Co.) and Lynchburg (S. S. Elayer) in the Magdalena district.

Mine production of recoverable lead in the United States, 1940–44 (average) and 1945–49, by States, in short tons

State	1940–44 (average)	1945	1946	1947	1948	1949
Western States and Alaska:						
Alaska	420	11	115	264	329	51
Arizona	14,822	22,867	23,930	28,566	29,899	33,568
California	4,378	7,224	9,923	10,080	9,110	10,318
Colorado	14,992	17,044	17,036	18,696	25,143	26,853
Idaho	100,729	68,447	59,987	78,944	88,544	79,299
Montana	18,755	9,999	8,280	16,108	18,411	17,996
Nevada	6,779	6,275	7,175	7,161	9,777	10,626
New Mexico	5,217	7,662	4,899	6,383	7,653	4,652
Oregon	25	1	2	12	7	12
South Dakota	34	----------	----------	8	16	4
Texas	117	----------	47	78	170	132
Utah	66,999	40,817	30,711	49,698	55,950	53,072
Washington	4,431	3,802	2,987	5,359	7,147	6,417
Wyoming	----------	3	----------	----------	----------	----------
Total	237,398	184,152	165,092	221,357	252,156	243,000
West Central States:						
Arkansas	14	1	2	18	22	1
Kansas	10,898	7,370	6,445	7,285	8,386	9,772
Missouri	179,420	176,575	139,112	132,246	102,288	127,522
Oklahoma	20,549	12,664	13,697	14,289	16,918	19,858
Total	210,881	196,610	159,256	153,838	127,614	157,153
States east of the Mississippi River:						
Illinois	2,048	3,005	3,865	2,325	3,695	3,824
Kentucky	277	129	95	214	216	187
New York	2,101	862	1,073	1,496	1,231	1,317
Tennessee	207	54	125	22	----------	257
Virginia	2,878	4,243	4,381	3,803	4,703	3,313
Wisconsin	956	1,776	1,588	1,166	861	857
Total	8,467	10,069	11,127	9,026	10,706	9,755
Grand total	457,046	390,831	335,475	384,221	390,476	409,908

Mine production of lead in States east of the Mississippi River came from properties in Illinois, Kentucky, New York, Tennessee, Virginia, and Wisconsin and totaled 9,755 tons, a drop of 9 percent from the 1948 output. Reduced production from the Austinville mine of the New Jersey Zinc Co. in Virginia accounted for most of the decrease. The principal lead producers in this region were the New

Jersey Zinc Co. of Virginia, Ozark-Mahoning Co. in Southern Illinois, St. Joseph Lead Co. in New York, and the Tri-State Zinc Co. in Northern Illinois. Lead was also recovered from ores mined in Oregon, South Dakota, and Texas. Virtually all the 51 tons of lead produced in Alaska in 1949 was recovered from the output of the Riverside mine near Hyder in the Southeastern Alaska region.

Mine production of recoverable lead in the United States, by districts that produced 1,000 tons or more during any year, 1940–44 (average) and 1945–49, in short tons

District	State	1940–44 (average)	1945	1946	1947	1948	1949
Southeastern Missouri region.	Missouri	176,032	173,005	135,796	129,516	100,654	126,269
Coeur d'Alene region	Idaho	92,848	63,430	56,548	73,060	82,587	74,152
West Mountain (Bingham).	Utah	35,794	22,723	12,343	26,163	30,672	32,600
Tri-State (Joplin region)	Kansas, southwestern Missouri, Oklahoma.	34,703	23,556	23,363	24,239	26,901	30,883
Warren (Bisbee)	Arizona	1,337	9,400	10,889	13,422	11,253	13,865
Summit Valley (Butte)	Montana	6,247	2,870	2,357	10,630	13,217	11,490
Park City region	Utah	16,361	8,916	8,373	10,987	12,670	8,583
Old Hat	Arizona	2,636	5,216	4,790	4,603	5,406	6,788
Tintic	Utah	7,943	4,930	4,239	6,166	5,970	6,676
Pioche	Nevada	4,421	2,987	3,493	3,487	5,613	6,630
Upper San Miguel	Colorado	1,584	1,986	2,376	2,559	3,804	5,285
California (Leadville)	do	3,191	5,016	4,441	4,296	4,745	5,080
Coso (Darwin)	California	1,173	5,214	7,708	6,551	6,078	4,928
Pima (Sierritas, Papago, Twin Buttes).	Arizona	609	2,063	2,296	2,909	3,917	4,232
Metaline	Washington	4,145	3,506	2,224	3,450	4,297	4,030
Ten Mile	Colorado	204	680	810	1,167	4,177	3,671
Big Bug	Arizona	925	1,961	2,155	2,323	2,676	3,330
Austinville	Virginia	2,666	4,222	4,381	3,803	4,703	3,313
Rush Valley and Smelter (Tooele County).	Utah	3,943	3,137	3,490	3,829	4,185	2,953
Animas	Colorado	2,507	2,613	3,207	2,241	1,886	2,935
Kentucky-Southern Illinois.	Kentucky, southern Illinois.	2,238	2,649	3,687	1,889	2,965	2,822
Central	New Mexico	3,670	5,379	3,199	3,450	3,740	2,479
Warm Springs	Idaho	4,227	2,347	1,649	1,879	1,304	2,339
Heddleston	Montana	1,619	3,175	2,648	2,087	1,946	2,335
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin.	1,044	2,261	1,861	1,816	1,807	2,046
Bossburg	Washington	16	158	428	1,010	1,394	2,011
Red Cliff	Colorado	1,713	572	690	924	1,120	1,600
Harshaw	Arizona	4,392	1,066	692	1,393	1,999	1,546
Pioneer (Rico)	Colorado	2,425	2,440	2,176	2,042	2,430	1,388
St. Lawrence County	New York	2,101	862	1,073	1,496	1,231	1,317
Battle Mountain	Nevada	70	33	45	39	234	1,290
Aravaipa	Arizona	112	291	467	794	1,142	1,271
Tomichi	Colorado	145	365	333	1,458	1,788	1,221
Magdalena	New Mexico	859	1,243	1,273	1,987	2,826	1,162
Creede	Colorado	431	303	246	329	451	1,162
Ophir	Utah	2,048	115	336	290	791	1,089
Bayhorse	Idaho	1,501	1,302	553	2,039	1,880	1,073
Sneffels	Colorado	321	442	(1)	(2)	756	1,064
Eagle	Montana	2,422	599	469	393	600	1,024
Modoc	California	21	862	279	139	1,061	729
Eureka	Colorado	41	59	300	630	1,107	578
Alder Creek	Idaho	37	38	136	1,103	776	442
Northport (Aladdin)	Washington	144	28	39	508	1,426	342
Resting Springs [1]	California	(2)	(2)	(2)	(2)	(2)	(2)

[1] Not listed in order of output.
[2] Bureau of Mines not at liberty to publish figures.

The 25 leading lead-producing mines in the United States in 1949, listed in the following table, yielded 66 percent of the total domestic lead output; the 10 leading mines produced 49 percent and the 4 leading mines 35 percent.

Twenty-five leading lead-producing mines in the United States in 1949, in order of output

Rank	Mine	District	State	Operator	Type of ore
1	Federal	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
2	United States and Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Zinc-lead.
3	Leadwood	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
4	Bunker Hill & Sullivan	Yreka	Idaho	Bunker Hill & Sullivan Mining & Conc ntrating Co.	Zinc-lead.
5	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp.	Do.
6	Mine La Motte	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
7	Page	Yreka	Idaho	Federal Mining & Smelting Co.	Zinc-lead.
8	Bonne Terre	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
9	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co.	Zinc-lead.
10	Madison	Southeastern Missouri	Missouri	St. Louis Smelting & Refining Co.	Lead-copper.
11	Mammoth-Collins	Old Hat	Arizona	St. Anthony Mining & Development Co.	Zinc-lead.
12	Star	Hunter	Idaho	Sullivan Mining Co.	Do.
13	Combined Metals group	Pioche	Nevada	Combined Metals Reduction Co.	Do.
14	Morning	Hunter	Idaho	Federal Mining & Smelting Co.	Do.
15	Chief, Gemini, etc.	Tintic	Utah	Chief Consolidated Mining Co.	Do.
16	Desloge	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
17	Darwin group	Coso	California	Anaconda Copper Mining Co.	Do.
18	Sherman	Lelande	Idaho	Day Mines, Inc.	Do.
19	San Xavier	Pima	Arizona	Eagle-Picher Mining & Smelting Co.	Zinc-lead.
20	Shoshone Group	Resting Springs	California	Anaconda Copper Mining Co.	Lead.
21	Kokomo unit	Ten-Mile	Colorado	American Smelting & Refining Co.	Zinc-lead.
22	Iron King	Big Bug	Arizona	Shattuck-Denn Mining Co.	Do.
23	Resurrection	Leadville	Colorado	Resurrection Mining Co.	Do.
24	Pend Oreille	Metaline	Washington	Pend Oreille Metal & Mining Co.	Do.
25	Park Utah	Uintah	Utah	Park Utah Consolidated Mining Co.	Do.

Detailed information on the production of mines and districts in the United States may be found in the chapters of this volume dealing with the mine production of gold, silver, copper, lead, and zinc in the various States.

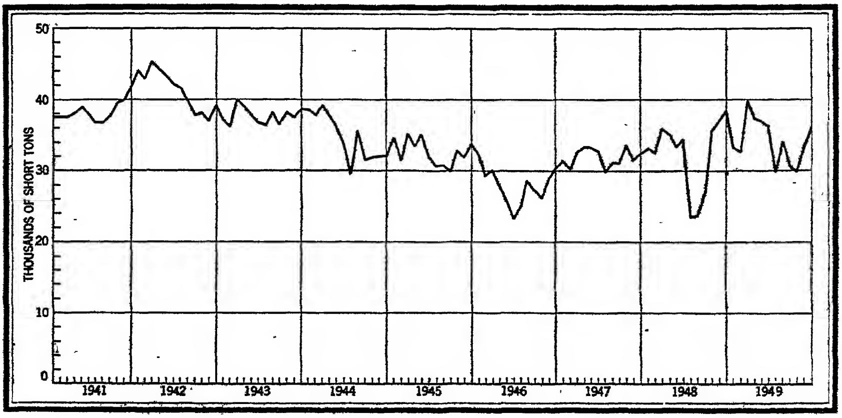

FIGURE 1.—Mine production of recoverable lead in the United States, 1941–49, by months.

Mine production of recoverable lead in the United States, 1948–49, by months, in short tons

Month	1948	1949	Month	1948	1949
January	33,246	33,203	August	23,685	34,021
February	32,517	32,667	September	27,279	30,607
March	35,999	39,916	October	35,687	29,887
April	35,200	37,215	November	36,986	33,225
May	33,370	37,006	December	38,542	36,047
June	34,543	36,278			
July	23,422	29,836	Total	390,476	409,908

SMELTER AND REFINERY PRODUCTION

Pig lead produced in the United States is derived from three main sources—domestic mine production, imports of foreign ores and base bullion, and secondary smelter output from scrap material, and is recovered at primary plants that treat ore, base bullion, and small quantities of scrap and at secondary plants that process scrap exclusively. Of the eight primary smelters operating in the Western States, only two (Selby, Calif., and Bradley, Idaho) produce refined merchant lead. The other six plants produce only base bullion (containing approximately 98 percent lead plus gold, silver, and small quantities of impurities recovered from the ore smelted), which is shipped to refineries in the Middle Western and Eastern States for recovery of the gold and silver and purification of the lead to meet commercial requirements. Both primary and secondary smelting plants may make refined lead or antimonial lead. Because of the large quantity of hard lead—such as battery scrap—melted at secondary smelters, the output from this type of operation is essentially antimonial lead alloys. Statistics on the production of refined lead and

alloys at secondary plants are given in the Secondary Lead section of this chapter. Of the 14 primary smelters and refineries in operation in the United States in 1949, all but 1 consumed primary raw materials in the form of ores and concentrates. During the year these 13 plants consumed 467,128 short tons (lead content) of this type of material, 16 percent of which was of foreign origin. In 1948 these same plants treated 432,543 tons of ores and concentrates, 16 percent of which was foreign.

ACTIVE LEAD SMELTERS AND REFINERIES

Primary lead smelters and refineries operating in the United States in 1949 were as follows:

California: Selby—Selby plant, American Smelting & Refining Co. (smelter and refinery).
Colorado: Leadville—Arkansas Valley plant, American Smelting & Refining Co. (smelter).
Idaho: Bradley—Bunker Hill Smelter, Bunker Hill & Sullivan Mining & Concentrating Co. (smelter and refinery).
Illinois: Alton—Federal plant, American Smelting & Refining Co. (smelter and refinery).
Indiana: East Chicago—U. S. S. Lead Refinery, Inc. (refinery).
Kansas: Galena—Galena plant, Eagle-Picher Co. (smelter and refinery).
Missouri: Herculaneum—Herculaneum plant, St. Joseph Lead Co. (smelter and refinery).
Montana: East Helena—East Helena plant, American Smelting & Refining Co. (smelter).
Nebraska: Omaha—Omaha plant, American Smelting & Refining Co. (refinery).
New Jersey: Barber—Perth Amboy plant, American Smelting & Refining Co. (smelter and refinery).
Texas: El Paso—El Paso plant, American Smelting & Refining Co. (smelter).
Utah:
  Midvale—Midvale plant, United States Smelting, Refining & Mining Co. (smelter).
  Murray—Murray plant, American Smelting & Refining Co. (smelter).[2]
  Tooele—Tooele plant, International Smelting & Refining Co. (smelter).

REFINED LEAD

Primary refineries in the United States in 1949 produced 500,568 short tons of refined lead, an increase of 22 percent over the 1948 output of 411,646 tons.

Refined lead produced at primary refineries in the United States, by sources, 1945–49, in short tons

Source	1945	1946	1947	1948	1949
Refined lead:					
From domestic ores and base bullion	356,535	293,309	381,109	339,413	404,449
From foreign ores	86,932	44.790	59,838	60,829	71,413
From foreign base bullion	118	98	63	6,452	1,476
Total from primary sources	443,585	338,197	441,010	406,694	477,338
From scrap	18,525	8,013	15,662	4,952	23,230
Total refined lead	462,110	346,210	456,672	411,646	500,568
Average sales price per pound	\$0.064	\$0.084	\$0.143	\$0.179	\$0.158
Total calculated value of primary refined lead [1]	\$55,780,000	\$56,820,000	\$126,130,000	\$145,600,000	\$150,840,000

[1] Excludes value of refined lead produced from scrap at primary refineries.

[2] Closed for lack of ore and other economic factors on October 1, 1949.

Of the 477,338 tons of primary lead produced in 1949, domestic ores and base bullion supplied 85 percent and foreign ores and imported base bullion 15 percent. In 1948 the origin was 83 percent domestic and 17 percent foreign. The following tables give the production of refined lead by sources and by country of origin of the ore. Details of the sources of lead from domestic ores are given in the Mine Production section of this chapter.

Refined primary lead produced in the United States, by country of origin, 1945–49, in short tons

Source	1945	1946	1947	1948	1949
Domestic ore and base bullion	356,535	293,309	381,109	339,413	404,449
Foreign ore:					
Australia	22,087	7,534	5,952	6,729	6,465
Canada	11,151	5,026	3,548	3,608	3,317
Europe				43	30
Mexico	3,097	2,056	5,523	4,427	8,477
South America	25,701	11,344	17,096	24,589	29,163
Other foreign	24,896	18,830	27,719	21,433	23,961
Total	86,932	44,790	59,838	60,829	71,413
Foreign base bullion:					
Australia				466	1,382
Mexico	63	10	30	5,637	36
South America	55	88	33	52	58
Other foreign				297	
Total	118	98	63	6,452	1,476
Total foreign	87,050	44,888	59,901	67,281	72,889
Grand total	443,585	338,197	441,010	406,694	477,338

ANTIMONIAL LEAD

Antimonial lead output at primary refineries in 1949 dropped sharply from the record level established in 1948. Production increased at only one of the five primary plants producing this alloy, whereas at the other plants declines of 50 to 92 percent from the 1948 outputs were recorded. Distribution of the lead according to source is shown in the following table. The average antimony content of antimonial lead produced in 1949 advanced to 8.2 percent, the highest average content recorded since 1941. Although antimonial lead is an important byproduct of the refining of base bullion, the quantity derived from this source is only a small part of the annual domestic output. The major production is recovered from the smelting of antimonial lead scrap at secondary smelters. Production data from lead-smelting plants treating scrap materials exclusively are summarized in the following section and discussed in detail in the Secondary Metals—Nonferrous chapter of this volume.

Antimonial lead produced at primary lead refineries in the United States, 1945–49

Year	Production (short tons)	Antimony content		Lead content by difference (short tons)			
		Short tons	Percent	From domestic ore	From foreign ore	From scrap	Total
1945	56,495	4,148	7.3	7,286	2,695	42,366	52,347
1946	50,480	3,285	6.5	11,196	2,149	33,850	47,195
1947	86,075	4,933	5.7	14,836	9,850	56,456	81,142
1948	100,764	5,760	5.7	29,561	15,918	49,525	95,004
1949	41,402	3,385	8.2	692	4,620	32,705	38,017

SECONDARY LEAD

Some scrap lead is treated at primary smelters and refineries, but the greater part is received at a large number of plants that treat secondary materials exclusively. Secondary lead is recovered in the form of refined lead, antimonial lead, and other alloys. Recovery at primary and other plants in 1945–49 is shown in the following table. Secondary lead recovery in 1949 surpassed the domestic mine output of recoverable lead for the fourth successive year. Further details appear in the Secondary Metals—Nonferrous chapter of this volume.

Secondary lead recovered in the United States, 1945–49, in short tons

	1945	1946	1947	1948	1949
As refined metal:					
At primary plants	18,525	8,013	15,662	4,952	23,230
At other plants	42,598	65,691	95,843	126,951	129,396
Total	61,123	73,704	111,505	131,903	152,626
In antimonial lead:					
At primary plants	42,366	33,850	56,456	49,525	32,705
At other plants	151,713	159,834	209,479	194,027	140,037
Total	194,079	193,684	265,935	243,552	172,742
In other alloys	107,837	125,399	134,530	124,616	86,815
Grand total:					
Short tons	363,039	392,787	511,970	500,071	412,183
Value	$46,468,992	$65,988,216	$146,423,420	$179,025,418	$130,249,828

LEAD PIGMENTS

The principal lead pigments are litharge, white lead, red lead, sublimed lead, leaded zinc oxide, and orange mineral. These products are manufactured for the most part from metal, but some ore and concentrates are converted directly to pigments. Details of the production of lead pigments are given in the Lead and Zinc Pigments and Zinc Salts chapter of this volume.

CONSUMPTION AND USES

Domestic lead consumption (including lead in lead ore used directly in the manufacture of lead pigments and salts) totaled 957,674 short tons in 1949. Of the total consumed, 592,682 tons were refined soft lead, 227,221 tons antimonial lead, 50,922 tons unmelted white scrap, 46,268 tons percentage metals, 15,976 tons copper-base scrap, 15,215 tons drosses and residues, and 9,390 tons from lead ores used directly

in the manufacture of lead compounds. During the year 77 percent of the total lead consumed was used in the manufacture of metal products. Production of the three largest lead-consuming items—batteries, cable covering, and tetraethyl fluid—used nearly 58 percent of all the lead consumed in 1949. Batteries took 33 percent of the total, cable covering 15 percent, and tetraethyl fluid 10 percent.

Consumption of lead in the United States in 1948 and 1949, in short tons

	1948	1949		1948	1949
Metal products:			Pigments:		
Ammunition	49,635	24,111	White lead	30,970	18,460
Bearing metals	42,594	29,189	Red lead and litharge	80,356	70,832
Brass and bronze	23,239	14,946	Pigment colors	10,832	8,400
Cable covering	171,654	144,340	Other[1]	20,230	9,515
Calking lead	31,473	34,944			
Casting metals	8,974	12,672	Total pigments	142,388	107,147
Collapsible tubes	11,071	8,692			
Foil	3,203	2,503	Chemicals:		
Pipes, traps, and bends	39,848	29,858	Tetraethyl lead	83,809	94,644
Sheet lead	31,559	27,144	Miscellaneous chemicals	10,280	4,191
Solder	71,025	62,104			
Storage batteries (antimonial lead)	203,869	175,308	Total chemicals	94,089	98,835
Storage batteries (oxides)	150,536	138,410	Miscellaneous uses:		
Terne metal	3,278	3,256	Annealing	6,132	4,935
Type metal	26,279	20,695	Galvanizing	1,995	1,228
			Lead plating	2,274	997
Total metal products	868,232	728,172	Weights and ballast	6,290	4,627
			Total miscellaneous uses	16,691	11,787
			Other uses unclassified	12,495	11,733
			Grand total	1,133,895	957,674

[1] Includes lead content of leaded zinc oxide production.

Consumption of lead in the United States 1948–49, by months, in short tons[1]

Month	1948	1949	Month	1948	1949
January	97,451	91,769	August	96,102	101,104
February	92,451	78,186	September	94,638	93,718
March	102,601	71,076	October	106,106	87,475
April	95,094	62,758	November	98,935	79,038
May	86,203	70,272	December	98,741	73,467
June	89,847	73,206			
July	75,726	75,605	Total	1,133,895	957,674

[1] Includes lead content of leaded zinc oxide production.

Lead consumption in the United States in 1949, by class of products and type of material, in short tons

	Soft and antimonial lead	Scrap, percentage metal, drosses, etc.	Total
Metal products	600,925	127,247	728,172
Pigments	97,756	1	97,757
Chemicals	98,835		98,835
Miscellaneous	11,361	426	11,787
Unclassified	11,026	707	11,733
Total	819,903	128,381	[1] 948,284

[1] Excludes 9,390 tons of lead contained in leaded zinc oxide.

STOCKS

Producers' Stocks.—Lead stocks, as reported by the American Bureau of Metal Statistics, are shown in the following table. Stocks of refined and antimonial lead include metal held by all primary refiners and by some of the refiners of secondary material who produce soft lead. According to monthly reports released by the American Bureau of Metal Statistics, stocks of refined lead and antimonial lead declined in the first 2 months of the year to a low of 36,101 tons at the end of February. Inventories gained sharply to 53,422 tons during March and continued to advance through April, May, and June to the peak 1949 level of 96,367 tons on July 1. Stocks declined slightly during July and dropped sharply in August and September to 60,208 tons on October 1. During the remainder of the year the inventories advanced steadily to 70,424 tons on December 31—a net gain of 82 percent from January 1.

Lead stocks at end of year at smelters and refineries in the United States, 1945–49, in short tons

[American Bureau of Metal Statistics]

	1945	1946	1947	1948	1949
Refined pig lead	37,584	40,870	13,634	29,050	61,329
Antimonial lead	7,283	6,717	7,694	9,594	9,095
Total	44,867	47,587	21,328	38,644	70,424
Lead in base bullion—					
At smelters and refineries	8,618	8,453	7,652	9,697	16,364
In transit to refineries	4,889	4,911	5,447	4,101	3,696
In process at refineries	15,097	16,042	16,328	17,939	15,561
Total	28,604	29,406	29,427	31,737	35,621
Lead in ore and matte and in process at smelters	89,462	111,836	77,199	76,373	95,481
Grand total	162,933	188,829	127,954	146,754	201,526

The Bureau of Mines annual survey of primary lead smelters and refiners indicated stocks of 29,048 tons (lead content) of refined lead at plants on January 1, 1949, and 60,826 tons on December 31, 1949. Primary antimonial lead stocks at these same plants decreased from 9,258 short tons (lead content) at the beginning of 1949 to 8,192 tons at the end of the year. In terms of lead content, stocks of ore and concentrates at the operating primary smelters and refineries increased 40 percent—from 44,038 tons to 61,736 tons during the same period. The inventory of base bullion at refineries that receive base bullion as a raw material and at smelters that produce base bullion for shipment to refineries totaled 7,743 tons at the beginning of January and 7,897 tons at the end of December 1949. The revised figure for January 1, 1948, is 7,728 tons. Stocks of in-process base bullion or work lead at five combination smelter-refinery plants are not included in reports to the Bureau of Mines. No direct comparison can be made between these data and the figures of the American Bureau of Metal Statistics. Figures reported to the Bureau of Mines represent physical inventory at the plants, irrespective of ownership, and do not include material in process or in transit.

Consumers' Stocks.—Consumers' stocks of lead decreased 18 percent during 1949. Inventories of refined lead gained 4 percent, but antimonial lead dropped 52 percent from the January 1 level. Total stocks, which on January 1, 1949, were 119,198 tons, advanced to 136,855 tons on March 31 and thereafter declined steadily to 97,267 tons on December 31.

Consumers' stocks of lead at the end of year, 1947–49, by types of materials, in short tons

Date	Refined soft lead	Antimonial lead	Unmelted white scrap	Percentage metals	Copper-base scrap	Drosses, residues, etc.	Total
Dec. 31, 1947	51,619	22,402	3,514	6,247	1,938	5,624	91,344
Dec. 31, 1948	62,077	35,088	4,828	7,932	2,301	6,972	119,198
Dec. 31, 1949	64,542	16,837	2,957	5,405	2,087	5,439	97,267

PRICES

The two major markets for lead in the United States are New York and St. Louis; much of the lead produced domestically is sold at prices normally based upon quotations in these markets. Since suspension of trading on the London Metal Exchange in September 1939, the London market has had no direct influence on New York quotations, and the differential between St. Louis and New York prices has remained 0.2 cent a pound, an amount approximating the freight charges between the two points.

The market price for common lead, New York, was quoted at 21.50 cents a pound until March 8, when it dropped to 19.50 cents. A series of price reductions followed thereafter until the quotation reached a low of 12.00 cents on May 26. A 1-cent increase occurred on July 8, and several additional increases established the quotation at 15⅛ cents on August 18. The price trended downward beginning September 26 and leveled off at 12.00 cents on November 21, where it remained the balance of the year.

The price of the British Ministry of Supply was £123 per long ton (equivalent to 22.10 cents a pound) at the beginning of 1949. On April 4 the price was reduced to £106 (19.05 cents) and on May 16, June 10, and July 12, further reductions to £95 (17.07 cents), £82 (14.73 cents), and £75 10s. (13.57 cents), respectively, took place. It was raised shortly thereafter to £81 (14.55 cents) on July 14 and continued to advance in three successive increases to £87 5s. (15.68 cents) on August 9. In mid-September the British pound was devalued, and price quotations were suspended for a few days. On September 22 the sterling price was £122 per long ton (equivalent to 15.25 cents a pound at the new $2.80 base). A reduction to £115 (14.38 cents) was announced, effective October 5 and on October 12 and 19 the price dropped to £111 (13.88 cents) and £105 (13.12 cents), respectively. A further decline to £97 (12.12 cents) occurred on November 23, at which level the quotation remained for the balance of the year.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1947–49, in cents per pound [1]

Month	1947			1948			1949		
	St. Louis	New York	London [2]	St. Louis	New York	London [2]	St. Louis	New York	London [2]
January	12.76	12.93	12.58	14.82	15.00	16.17	21.32	21.50	22.10
February	13.01	13.18	12.58	14.82	15.00	16.17	21.32	21.50	22.10
March	14.77	14.96	12.58	14.82	15.00	16.17	18.73	18.91	22.10
April	14.82	15.00	16.17	17.04	17.21	16.17	14.99	15.16	19.28
May	14.82	15.00	16.17	17.32	17.50	16.17	13.57	13.72	17.98
June	14.82	15.00	16.17	17.32	17.50	16.17	11.85	12.00	15.45
July	14.82	15.00	16.17	17.63	17.81	16.17	13.39	13.56	14.59
August	14.82	15.00	16.17	19.32	19.50	16.17	14.80	15.01	15.56
September	14.82	15.00	16.17	19.32	19.50	16.17	14.85	15.05	15.51
October	14.82	15.00	16.17	19.32	19.50	20.12	13.23	13.42	13.79
November	14.82	15.00	16.17	21.32	21.50	20.12	12.33	12.52	12.79
December	14.82	15.00	16.17	21.32	21.50	20.12	11.80	12.00	12.12
Average	14.50	14.67	15.27	17.87	18.04	17.16	15.18	15.36	16.95

[1] St. Louis: Metal Statistics, 1950, p. 507. New York: Metal Statistics, 1950, p. 501. London: E&MJ Metal and Mineral Markets.
[2] Conversion of English quotations into American money based on average rates of exchange recorded by Federal Reserve Board.

FOREIGN TRADE [3]

Tariff.—The import duty set by the Tariff Act of 1930 on lead-bearing ores, flue dust, and mattes (lead content) was $1\frac{1}{2}$ cents per pound and on lead bullion, pigs, bars, scrap lead, antimonial lead, type metal, babbitt metal, solder, and alloys not specifically provided for, $2\frac{1}{8}$ cents per pound. In accordance with the Mexican Trade Agreement of January 30, 1943, these rates were reduced to $\frac{3}{4}$ cent and $1\frac{1}{16}$ cents per pound, respectively. In June 1948 these duties were suspended for 1 year by act of Congress. As the Congress took no action on a bill to extend the suspension beyond June 30, 1949, the expiration date of the original legislation, the import duty of $1\frac{1}{16}$ cents a pound on pig lead and $\frac{3}{4}$ cent a pound on lead in ores and concentrates was reinstated automatically on July 1.

Imports.—Total imports of lead increased in 1949 to a record peacetime high but remained well below the wartime peak level established in 1942. As in previous years, the greater part of the lead imported was in the form of pigs and bars, 46 percent of which came from Mexico, 20 from Canada, 13 from Peru, 9 from Yugoslavia, 6 from Australia, and 6 from 17 other countries. Imports of lead in base bullion, virtually all from Australia, were approximately one-third the quantity imported in 1948. Receipts of lead in ore, concentrate, and matte, principally from Africa, Bolivia, Peru, Australia, Newfoundland, and Mexico, were the largest since 1940.

[3] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Total lead imported into the United States in ore, matte, base bullion, pigs, bars, and reclaimed, by countries, 1945–49, in short tons [1]

[U. S. Department of Commerce]

Country	1945	1946	1947	1948	1949
Ore and matte:					
Africa	2,338	399	5,616	10,142	31,373
Argentina	4,716	2,112	6		
Australia	17,913	[2] 8,268	7,054	9,017	8,983
Bolivia	1,580	2,202	6,234	20,369	24,098
Canada	8,687	[2] 4,892	4,310	3,488	1,917
Newfoundland-Labrador	17,046	19,037	10,523	4,800	8,409
Chile	2,330	1,456	3,048	3,430	3,395
Guatemala				23	2,827
Mexico	667	376	3,065	2,702	8,388
Peru	14,524	5,192	10,477	8,548	14,970
Other countries	204	352	419	1,388	2,919
Total ore and matte	70,005	[2] 44,286	50,752	63,907	107,279
Base bullion:					
Australia					2,246
Korea			285	82	
Mexico	8		1,255	6,455	25
Peru		125	40	619	102
Other countries				30	
Total base bullion	8	125	1,580	7,186	2,373
Pigs and bars:					
Africa			78	[2] 507	280
Australia	13,747	[2] 8,210	10,639	30,469	17,192
Belgium-Luxembourg				8,911	212
Burma				2,343	1,414
Canada	19,389	[2] 23,029	59,079	[2] 53,978	56,421
Germany					8,333
Italy				21,349	3,419
Japan		[2] 15,161			2,108
Korea			1,659	[2] 39	51
Mexico	160,179	53,534	85,783	[2] 98,460	126,398
Netherlands				1,826	219
Peru	34,153	15,568	1,151	23,559	34,626
Spain				1,653	
Yugoslavia			1,120	2,889	23,436
Other countries	1	1	4	1,133	1,131
Total pigs and bars	227,469	[2] 115,503	159,513	[2] 247,116	275,240
Reclaimed, scrap, etc.:					
Africa			478	[2] 344	479
Australia	1,470	[2] 1,410	1,111	3,690	2,971
Belgium-Luxembourg				986	1,329
Canada	1,374	1,078	8,070	11,649	1,817
Canal Zone		9	202	447	384
Chile			62		
France		(3)		(3)	289
Germany					668
Italy			69	2,304	346
Japan			5,336		2,765
Malta, Gozo, and Cyprus			78	155	
Mexico		[2] 1		1,644	845
Netherlands				2,460	599
Panama		12	41	223	92
Philippines			433	2,341	1,144
Yugoslavia				652	
Other countries		29	145	2,002	1,926
Total reclaimed, scrap, etc	2,844	[2] 2,539	16,025	[2] 28,897	14,649
Grand total	300,326	[2] 162,453	227,870	[2] 347,106	399,541

[1] Data include lead imported for immediate consumption plus material entering the country under bond.
[2] Revised figure.
[3] Less than 1 ton.

Lead imported for consumption in the United States, 1945–49, by

[U. S. Department of Commerce]

Year	Lead in ores, flue dust, and mattes, n. s. p. f		Lead in base bullion		Pigs and bars		Sheets, pipe, and shot		Not otherwise specified (value)	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1945	76,126	$5,758,695	20	$2,242	227,311	$25,280,638	17	$2,778	$32,515	$31,312,708
1946	[2] 28,255	[2] 3,042,765	20	2,302	[2] 104,083	[2] 14,816,926	24	10,251	21,517	[2] 18,089,893
1947	[2] 44,442	[2] 8,561,174	1,758	416,643	158,705	38,008,443	67	42,434	10,453	[2] 50,111,298
1948	33,932	8,350,507	10,922	3,239,135	[2] 244,692	[2] 80,922,779	181	100,519	35,554	[2] 100,968,922
1949	121,848	34,397,026	1,133	374,954	272,437	80,048,110	168	101,084	29,830	118,954,978

[1] In addition to quantities shown (value included in total values), "reclaimed, scrap, etc.," imported as follows—1945: 2,848 tons, $235,840; 1946: Revised figures, 2,539 tons, $196,132; 1947: 15,963 tons, $3,072,151; 1948: Revised figure, 28,897 tons, $8,320,428; 1949: 14,005 tons, $4,003,974. Figures for 1945–49 include lead received by the Government and held in stockpiles.

[2] Revised figure.

Miscellaneous products, containing lead, imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Babbitt metal, solder, white metal, and other combinations containing lead			Type metal and antimonial lead		
	Gross weight (short tons)	Lead content (short tons)	Value	Gross weight (short tons)	Lead content (short tons)	Value
1945	143	73	$101,132	26,110	24,730	$3,241,735
1946	157	[1] 83	211,122	1,740	1,494	220,645
1947	[1] 264	[1] 171	[1] 208,185	2,406	2,219	753,664
1948	257	184	213,614	[1] 14,732	[1] 13,163	[1] 5,279,080
1949	287	129	463,900	5,861	5,207	2,255,909

[1] Revised figure.

Exports.—Total exports of pig lead (excluding reexports of foreign refined lead) increased from 411 tons (revised figure) in 1948 to 969 tons in 1949. Export restrictions imposed under the Export Control Act of 1940 remained in force throughout 1949.

Lead pigs, bars, and anodes exported from the United States, by destinations, 1945–49, in short tons [1]

[U. S. Department of Commerce]

Destination	1945	1946	1947	1948	1949
Countries:					
Argentina			894	2	7
Belgium-Luxembourg					76
Brazil	406	281	63	1	126
Canada	[2] 9	40	[2] 10	[2] 8	14
Canal Zone		6	52		15
Chile	215	2	52	42	40
China		[2] 9	[2] 10	21	
Colombia	25	49	12	16	60
Cuba	156	58	38	40	68
Czechoslovakia		10			
Denmark					131
El Salvador	(3)			1	34
Honduras	4			1	29
Hong Kong			27	2	
India		(3)	19	121	4
Madagascar			44		
Mexico	32	17	[2] 16	14	3
Netherlands		1	100	[2] 1	
Netherlands Antilles	14	11			(3)
Panama	23	17	(3)	1	(3)
Philippines		16	23	1	53
Portugal	257				3
Saudi Arabia	13	11	3	24	7
Turkey	22		50	11	7
U. S. S. R.	66		5		
Uruguay	2	10	27		69
Venezuela	75	34	30	[2] 71	148
Other countries	89	26	48	33	75
Total	[2] 1,408	[2] 598	[2] 1,523	[2] 411	969
Continents:					
North America	[2] 274	170	[2] 144	[2] 75	179
South America	761	381	1,078	[2] 133	475
Europe	323	11	118	[2] 10	215
Asia	44	[2] 36	[2] 137	189	85
Africa and Oceania	6	(3)	46	[2] 4	15
Total: Short tons	[2] 1,408	[2] 598	[2] 1,523	[2] 411	969
Value	$219,377	$107,124	$388,599	$169,075	$356,819

[1] In addition 377 tons of foreign lead were reexported in 1945, 103 tons in 1946, 102 tons in 1947, none in 1948, and 86 tons in 1949.
[2] Revised figure.
[3] Less than 1 ton.

WORLD REVIEW

Lead is produced in many countries, but four—United States, Mexico, Australia, and Canada—have accounted for nearly three-quarters of the world output in recent years, as is apparent from the accompanying tables, which show world mine and smelter production by countries, 1943–49, insofar as statistics are available.

World mine production of lead, by countries, 1943–49, in metric tons [1]

Country	1943	1944	1945	1946	1947	1948	1949
Algeria	400	1,100	200	1,000	1,300	1,044	1,057
Argentina	17,700	20,000	18,200	18,100	20,900	21,800	16,000
Australia	209,700	192,500	167,300	186,700	199,800	207,776	203,445
Austria	(2)	(3)	1,272	981	1,528	3,007	4,297
Belgian Congo	1,000	1,300	786	1,043	1,700	500	72
Bolivia	11,400	9,000	9,500	8,400	11,300	25,600	26,352
Burma [4]	------	------	------	------	------	7,570	2,318
Canada	201,400	138,200	157,400	160,600	146,700	151,700	145,600
Newfoundland	32,900	29,700	25,300	25,200	21,100	20,100	19,819
Chile	------	------	100	100	------	------	730
Czechoslovakia	2,359	2,177	1,100	2,200	(3)	(3)	(3)
Finland	300	200	100	300	300	72	130
France	5,500	4,100	4,900	8,300	7,500	7,413	10,009
French Equatorial Africa	3,200	2,600	2,900	2,800	2,700	2,600	700
French Morocco	6,900	9,700	11,100	11,000	21,000	28,852	37,489
Germany	[2] 107,400	(2)	(3)	15,400	14,800	22,400	40,944
Greece	[4] 1,150	[4] 600	[4] 700	[4] 1,127	[4] 948	1,280	2,051
Hungary	400	------	------	100	200	------	(3)
Italy	19,200	3,900	2,300	13,300	20,300	26,500	35,000
Japan	21,200	17,000	4,900	4,800	6,200	6,700	9,106
Korea:							
North	20,700	13,700	(3)	(3)	(3)	(3)	(3)
South			2,096	------	900	300	80
Mexico	218,100	185,300	205,300	140,100	223,100	193,300	220,763
Nigeria	------	------	------	------	100	------	(3)
Northern Rhodesia	1,300	1,000	1,700	8,400	15,900	11,700	14,169
Norway	100	100	------	------	100	------	330
Peru	47,800	52,500	53,700	44,500	54,800	48,500	49,302
Rumania	200	300	3,363	1,300	3,495	------	(3)
Southern Rhodesia	------	300	------	------	------	------	83
South-West Africa	------	------	------	------	13,092	25,363	31,976
Spain	33,500	32,000	27,600	36,400	29,900	27,300	29,500
Sweden	11,400	16,200	20,100	21,300	20,900	23,579	23,900
Tunisia	2,400	6,200	6,400	7,852	12,340	13,481	14,989
Turkey	------	136	------	------	------	------	168
Union of South Africa	200	100	200	200	100	------	(3)
U. S. S. R. (estimated) [4]	50,000	45,000	40,000	48,000	63,000	75,000	90,000
United Kingdom	4,200	4,000	2,900	2,600	2,900	2,312	2,122
United States	411,236	378,168	354,554	304,336	348,558	354,232	371,860
Yugoslavia	(3)	(3)	18,500	43,200	51,600	41,700	36,300
Total	1,443,000	1,217,000	1,144,000	1,120,000	1,321,000	1,354,000	1,446,000

[1] Data derived from the United Nations Statistical Yearbook, Year Book of the American Bureau of Metal Statistics and other sources.
[2] Figure for Austria included with Germany.
[3] Data not available, estimate by author of chapter included in total.
[4] Smelter output.

World smelter production of lead, by countries where smelted, 1943–49, in metric tons [1]

[Compiled by Berenice B. Mitchell]

Country	1943	1944	1945	1946	1947	1948	1949
Argentina	23,800	19,100	21,159	16,190	17,800	17,830	15,000
Australia	192,322	157,026	158,353	139,665	161,093	162,057	185,300
Austria	12,043	10,123	1,272	4,476	3,795	9,350	9,841
Belgium [2]	7,960	7,690	7,340	23,762	40,520	66,035	79,304
Burma	-----	-----	-----	-----	-----	7,570	2,318
Canada	203,091	129,347	147,964	150,360	147,104	145,246	132,608
China	1,179	153	850	14	771	834	(3)
Czechoslovakia	(4)	(4)	645	2,800	4,460	5,770	(3)
France	12,428	1,923	2,765	32,010	36,623	34,702	54,450
French Indochina	16	51	-----	-----	-----	-----	-----
Germany: [5]							
Federal Republic	157,260	[8] 139,900	(3)	[7] 27,659	[2] [7] 24,356	[2] [7] 49,382	[2] 99,372
Soviet Zone					(3)	(3)	(3)
Greece	1,150	600	700	1,727	948	1,166	1,706
Guatemala	114	136	115	131	110	(3)	68
Hungary	6,370	[8] [9] 3,230	[9] 10	10	60	(3)	(3)
India	-----	-----	-----	-----	234	554	593
Italy	17,715	2,229	2,826	14,269	17,701	26,734	26,346
Japan	[6] 32,511	[6] 38,048	[6] 12,568	4,965	8,818	10,197	12,619
Korea:							
North	18,467	21,200	2,548	[6] 2,000	[6] 2,000	(3)	(3)
South				-----	250		
Mexico	212,452	178,270	201,078	137,742	217,827	187,067	212,004
Northern Rhodesia	1,265	1,047	1,748	8,371	15,891	13,229	14,169
Norway	-----	-----	52	36	48	-----	-----
Peru	43,171	38,906	40,001	36,478	32,810	34,297	36,027
Poland	15,506	15,833	[6] 7,000	10,915	12,761	16,874	[6] 17,000
Rumania	187	261	3,363	3,225	3,316	(3)	(3)
South-West Africa	-----	-----	-----	-----	64	82	-----
Spain	36,760	39,978	31,922	32,346	34,382	20,926	27,364
Sweden	2,193	10,553	12,501	11,223	9,229	6,228	10,757
Tunisia	1,867	6,335	7,023	7,498	9,891	18,060	19,498
U. S. S. R. [5]	50,000	45,000	40,000	48,000	63,000	75,000	[6] 90,000
United Kingdom [5]	4,064	3,556	2,743	2,540	2,852	2,312	2,122
United States (refined) [10]	425,903	421,538	402,304	306,717	400,018	363,092	431,692
Total (estimate)	1,492,000	1,292,000	1,119,000	1,040,000	1,309,000	1,350,000	1,563,000

[1] Data derived in part from Monthly Bulletin of the United Nations, The Mineral Industry of the British Commonwealth and Foreign Countries Statistical Summary, and the Year Book of the American Bureau of Metal Statistics. Estimate for Yugoslavia included in total.

[2] Includes scrap.

[3] Data not yet available; estimate by author of chapter included in total.

[4] Included with Germany.

[5] Exclusive of secondary material. Includes Upper Silesia and Sudetenland through 1944.

[6] Estimate.

[7] American and British zones only.

[8] January to June, inclusive.

[9] Data represent Trianon Hungary after October 1944.

[10] Figures cover lead refined from domestic and foreign ores; refined lead produced from foreign base bullion not included.

Argentina.—The chief lead-producing district in Argentina is the Aguilar, where the Compania Minera Aguilar, S. A., a subsidiary of the St. Joseph Lead Co., operates the Aguilar group of mines. Production in 1949 was at a rate approximately 40 percent under the installed mill capacity due to continued difficulty of obtaining adequate transportation facilities to maintain incoming shipments of machinery, Diesel oil, mine timber, and miscellaneous supplies, as well as shipments of concentrates to the smelter. The output of lead concentrates in 1949 totaled 19,142 metric tons compared with 24,068 tons in 1948. Lead concentrates from the Aguilar mine are smelted at the National Lead Co., S. A., smelter at Barranquera, Chaco Territory, which also treats lead ores and concentrates imported from Bolivia.

Australia.—Although most lead producers reported increased outputs in 1949, transportation difficulties and shortages of steel and skilled labor continued to restrict production.

As in previous years, the famous Broken Hill lode in New South Wales accounted for a substantial portion of Australian lead production in 1949. Output from the northern limb of the lode, operated by the North Broken Hill, Ltd., increased slightly over 1948, despite the company's continued difficulty in obtaining skilled mine labor. A total of 327,205 tons of ore was mined, most of which assayed 15.0 percent lead, 12.3 percent zinc, and 7.5 ounces of silver per ton. Nearly 330,000 tons of ore were milled, but owing to an increased quantity of partly oxidized ore in the mill feed, recoveries of lead and zinc in the concentrates dropped slightly from the record achieved in 1948. At Broken Hill South, Ltd., on the southern limb of the lode, production for the year ended June 30, 1949, totaled 267,028 tons of ore assaying 12.9 percent lead, 12.2 percent zinc, and 7.4 ounces of silver per ton, from which 44,314 tons of lead concentrates containing 74.5 percent lead were recovered. Other companies operating in the Broken Hill area in 1949 included the Zinc Corp., Ltd., and the New Broken Hill Consolidated, Ltd.

The Lake George Mining Corp., Ltd., at Captain's Flat, New South Wales, was in full operation only 67 days in the year ended June 30, 1949, due to a labor strike which began on October 12, 1948, and to a strike of coal miners in New South Wales.

Lead and zinc production continued to be emphasized at the Mount Isa mines in northwest Queensland in 1949. Some difficulty was experienced in obtaining adequate rail transportation facilities and maintaining an adequate supply of coal for the company steam power plant. The copper section of the mine remained idle pending completion of the new copper milling and smelting plant that is expected to treble Queensland's copper production.

In the Read-Rosebery district of Tasmania, from which approximately 4 percent of the Australian lead production is derived, the Electrolytic Zinc Co. of Australasia continued to operate its Rosebery and Hercules mines. The Rosebery ore averages 21.3 percent zinc, 6.4 percent lead, 0.5 percent copper, 8.5 ounces of silver, and 2.1 dwt. gold per ton; ore at the Hercules mine averages slightly higher in grade. Ore from both properties is treated at the company mill at Rosebery. Lead concentrates produced are exported to the United States for treatment.

Bolivia.—The largest producer of lead, as well as silver and zinc, in Bolivia is the mine of the Cia. Huanchaca de Bolivia at Pulacayo in the Tupiza lead mining region. Ore from this mine, which has been worked more than 100 years, contains 1.5 percent lead, 3.5 percent zinc, 0.5 percent copper, and 15 ounces of silver per ton; it is treated in the company 1,000-ton per day selective flotation mill. The remainder of Bolivia's lead output is obtained from a number of small operators employing primitive hand methods of mining and concentrating. As there is no lead smelter or refinery in Bolivia, all ores and concentrates must be exported for further treatment. Banco Minero, a Bolivian Government subsidiary which by law controls the ore-buying business, began construction during 1949 of a small lead smelter near La Paz designed to treat 5 tons of lead concentrates per day. If

operation of this smelter proves successful, the Government will build near Tupiza a 20-ton-per-day smelter capable of processing both ores and concentrates. The problem of maintaining adequate fuel supplies for both smelters has not been solved. Coke is being imported for the smelter near La Paz.

Burma.—Rehabilitation of the war-damaged Burma Corp., Ltd., Bawdwin mine progressed slowly in 1949. The mine was unwatered to a depth somewhat below the No. 12 level, and ore was extracted for the first time since Japanese occupation. However, due to intensified insurgent activities beginning in the early part of the year, which completely immobilized rail connections with Rangoon and Mandalay, the company was forced to discontinue operations in March after reaching a peak monthly mine output of 2,350 tons. The operators have reported [4] that, until rail traffic can be resumed, the mine and smelter are on standby basis. A crew of skilled personnel has been retained to keep the plant and property in working order. Negotiation with the Government of the Union of Burma continued in the early part of 1950 for renewal of the Bawdwin lease which expired December 31, 1949.

Canada.—At Kimberley, British Columbia, the Sullivan mine of the Consolidated Mining & Smelting Co. continued to be the principal source of Canadian lead. Ore production in 1949 totaled 2,297,672 tons compared with 2,283,625 tons in 1948. The company reports [5] that the grade of ore was lower in 1949 due to more extensive pillar mining and the resulting dilution of ore, in addition to mining a greater tonnage of low-grade material to effect higher over-all metal recovery from the mine. New facilities installed and put into operation in 1949 include the underground crushing plant, 3,700-foot level adit and haulageway to the mill, and sink-float plant. Treatment of ore in the sink-float plant was begun in May; approximately 2,000 tons of waste are rejected by this operation daily. Concentrates from the Sullivan mine were treated at the company smelter at Trail, B. C., with ores and concentrates received from 97 other mining properties in Canada, United States, Asia, Australia, and South America. Production of pig lead at this smelter, the only lead smelter and electrolytic lead refinery in Canada, dropped from 160,107 tons in 1948 to 146,176 tons in 1949. Completion of a second slag-fuming furnace in August made possible treatment of all current lead-blast-furnace slag and zinc-plant residues, as well as substantial quantities of these materials accumulated in past years. A program outlining certain changes in lead-smelting techniques was announced during the year. The present method of blending ores, fluxes, and concentrates is to be replaced, a new sintering plant is to be built, and new facilities for handling slag and lead bullion are to be provided.

Other lead producers in British Columbia include Canadian Exploration, Ltd., which began milling silver-lead-zinc ore from its Jersey property south of Salmo in January; the Torbrit Silver Mines, Ltd., at Alice Arm; the Silver Standard property at Hazelton; Base Metals Mining Corp., Ltd., near Field; and the Highland-Bell Ltd., at Beaverdell.

[4] Burma Corp., Ltd., 1949 Annual Report to Stockholders.
[5] Consolidated Mining & Smelting Co., 1949 Annual Report to Stockholders.

The Buchans Mining Co. Ltd., Newfoundland, reported [6] discovery of new lead-zinc ore bodies northwest of the Lucky Strike mine, which will prolong the life of the property until 1960.

Chile.—Lead production was reported in 1949 from the Compania Minera Aysen mine on the north shore of Lago Buenos Aires in Aysen Territory of southern Chile. Construction of a 60-ton-per-day lead-zinc flotation mill was begun during the year and scheduled for completion in mid-1950. Because of poor transportation facilities to Chilean ports, the ore produced in 1949 was sold to an Argentine subsidiary of the French Peñarroya Co. for treatment at the lead smelter at Barranqueras, Chaco Territory.

France.—The lead refinery of the Société Min. et Met. de Peñarroya in southern France was put back into production during 1949 to treat lead bullion recovered at the Peñarroya-Zellidja smelter at Oued-el-Heimer in French Morocco.

French Morocco.—The most important lead mine in French Morocco is the Bou-Bekar property 50 kilometers southeast of Oujda, on the Algerian-Moroccan border, and operated by Société Nord Africaine du Plomb. This company is owned jointly by Société des Mines de Zellidja (51 percent), Newmont Mining Corp. (33 percent), and St. Joseph Lead Co. (16 percent). French-American technical collaboration, financed in part by an advance of funds through the Marshall Plan, has made modernization and expansion of this property possible. Improvements include a new concentrating mill, additional equipment within the mine, a new smelter, additional facilities for generating electric power, new dwellings for employees, and a new access road. By 1954 it is expected that mine production will reach 60,000 metric tons of lead metal and 60,000 tons of zinc metal annually.

Greece.—During 1949 an application for a European Cooperation Administration industrial loan was filed by the General Mining Co. of Greece. Funds made available will be used to finance exploration of lead-zinc outcrops on the island of Chios. Deposits on the islands of Samothrake and Thasos were also to be examined. At the French Laurium mines work on three new mine headings was under way to increase the output of high-grade lead-zinc ores. The Kirka mine in northern Greece was leased during the year by Mediterranean Mines, Inc., a subsidiary of Ventures, Ltd.

Greenland.—A Danish Government geological survey party returned to Greenland in the summer of 1949 for further study of the lead deposits on the east coast at Mesters Vig in the area around King Oscar Fjord and Davy Sound. Results of the survey were not announced nor were any plans for exploitation of the deposit. The survey party which discovered the deposit in the summer of 1948 reported ore samples assaying 80 percent lead and 300 grams of silver per ton. The deposit is thought to contain 1 million tons of lead.

Mexico.—Problems of mine taxation, rail freight rates, and deficient rail service continued burdensome to Mexican mine operators in 1949. Compared with 1948, the labor disputes were relatively few and quickly settled. During the year the American Smelting & Refining Co. completed its New Taxco, Guerrero, unit mill at a cost

[6] American Smelting & Refining Co., 1949 Annual Report to Stockholders.

of $1,000,000. The 800-ton daily capacity zinc-lead flotation plant will provide a market for ores from the Taxco area and also from the La Concha region in Guerrero. A diamond-drilling program was undertaken by the American Smelting & Refining Co. at the Nuestra Señora property in the Cosala district, Sinaloa. The company reports [7] development of a worth-while tonnage of lead-zinc ore.

Peru.—The new 330-ton flotation mill of the Compania Minera Atacocha, near Cerro de Pasco, began operations March 5, 1949. The Atacocha mine, owned and managed by Peruvians, is one of the most important lead-silver-zinc producers in Peru. Increased production from the Huachocolpa region was anticipated with completion of the Banco Minero del Peru 100-ton sink-float plant and 50-ton concentration mill. In the Chiquian mining region in the Department of Ancash, lack of access roads continued to delay development of properties. A 20-ton mill was recently installed in the region by Compania Argento Bolognesi. A 150-ton flotation plant was installed at the Empresa Minera Huamachuco property in the Department of La Libertad. Mills were also installed at the Caudalosa mine near Castrovirreyna, inland from Pisco, and at the north Peruvian mine operated by the Compania Minera Tarica.

Tanganyika.—Uruwira Minerals, Ltd., continued to develop its lead deposit at Mpanda. The main shaft was sunk to 1,200 feet and exploration pushed ahead at various levels. Approximately 5,000,000 tons of ore averaging 6.48 percent lead, 0.61 percent copper, 118.7 grams of silver, and 2.1 grams of gold per ton are reported [8] to have been developed as a result of current investigations. A pilot plant capable of treating 100 tons of ore per day was installed during the year. Lead concentrates produced at the mill will be stockpiled until completion of the railway link between Mpanda and Kaliua, on the Central Line of the Tanganyika Railways west of Tabora. At the end of 1949 completed track extended 138 kilometers from Kaliua, leaving 72 kilometers to be laid. It is anticipated that work on this line will be completed in 1950.

[7] American Smelting & Refining Co., 1949 Annual Report to Stockholders.
[8] Mining Journal, vol. 233, No. 5950, pp. 807–808.

Lead and Zinc Pigments and Zinc Salts

By Helena M. Meyer and Alethea W. Mitchell

GENERAL SUMMARY

DESPITE diversified movements in industries that are the chief consumers of pigments, there were sharp declines in 1949 in shipments of all of the lead and zinc pigments and zinc salts covered by this report. The decreases in lead pigments ranged from 19 percent for red lead to 41 percent for white lead (dry), in zinc pigments from 27 percent for zinc oxide (lead-free) to 46 percent for the leaded variety; they were 20 and 7 percent, respectively, for zinc chloride and zinc sulfate.

The following trends were noted among the industries that consume large quantities of pigments: Automobile production rose 17 percent to a new all-time peak; total value of construction put in place, both private and public, exceeded $19 billion, surpassing the 1948 record by 3 percent; the value of sales of paints, varnish, and lacquer materials, on the other hand, fell about 9 percent; consumption of natural rubber 8 percent and of the synthetic type 6 percent; and production of synthetic rubber dropped 23 percent, indicating a more pronounced decline in need for pigments than consumption data showed. The relatively greater drop in pigments than in the level of activity in pigment-consuming industries may be explained by a reduction in inventories of pigments at consumers' plants.

Shipments of white lead (dry) dropped 41 percent and of the in-oil variety 40 percent, being the smallest by far for both grades since considerably before the beginning of the present century; total white lead shipments amounted to only 27 percent of the annual average for 1935–39. Litharge shipments declined 22 percent in 1949 and were the smallest since 1943. Red-lead shipments decreased 19 percent, the smallest decline of the pigments covered by this report, and were the lowest since 1933.

Lead-free zinc-oxide shipments dropped 27 percent and were smaller than in any year since 1942, when there were insufficient supplies of zinc metal and scrap for manufacture of the French-process type. The labor strike beginning September 26 and continuing beyond the end of 1949, at the Palmerton plant of the New Jersey Zinc Co., curtailed both production and shipments of the leaded as well as the lead-free grades and likewise reduced tonnages of lithopone. Leaded zinc-oxide shipments fell 46 percent and lithopone 44 percent and were the smallest since 1935 and 1921, respectively.

The World War II and early postwar situation of inadequate supplies of pig lead in relation to consumption requirements was reversed in 1949, when domestic production and peacetime peak imports considerably exceeded demand. Supplies of zinc in 1949 likewise were

more than adequate for all needs. The foregoing situation was due in part to the drop in general industrial activity that began before midyear. This decline was largely counterbalanced by increased industrial activity in the late months of 1949.

Lead-pigment prices reached new peaks in 1947 and 1948 and continued at top levels early in 1949. Zinc-pigment prices likewise were very high during the period. The break in nonferrous metal prices in the spring and early summer of 1949 was accompanied by lower prices for pigments. December prices for lead and zinc both were 44 percent below those for January. Pig lead and lead pigments were at their lowest levels in the second quarter of the year and had substantial recovery in the third; resumption of the downtrend resulted in a return in December to the lowest levels of the year. Slab zinc and zinc pigments followed the same pattern, in general, but were mostly above the year's lowest levels at the end of December.

Zinc-chloride and zinc-sulfate shipments decreased 20 and 7 percent, respectively, and were the lowest since 1943 and 1944, respectively.

Salient statistics of the lead and zinc pigments industry of the United States, 1940–44 (average) and 1945–49

	1940–44 (average)	1945	1946	1947	1948	1949
Production (shipments)[1] of principal pigments:						
White lead (dry and in oil) short tons	87,819	51,170	[2] 66,501	68,787	46,070	27,355
Red lead do	50,351	47,381	32,526	36,064	30,787	24,866
Litharge do	110,986	138,798	133,799	167,050	154,775	121,052
Zinc oxide do	129,160	127,955	157,851	160,771	150,958	110,132
Leaded zinc oxide do	54,127	62,598	67,971	81,459	67,441	36,722
Lithopone do	148,878	136,161	147,001	165,024	140,033	78,335
Value of products:						
All lead pigments	$41,418,000	$39,045,000	$43,595,000	[3] $90,199,000	[3] $90,915,000	[3] $58,564,000
All zinc pigments	34,858,000	36,644,000	44,195,000	63,891,000	65,547,000	43,152,000
Total	76,276,000	75,689,000	87,790,000	[3] 154,090,000	[3] 156,462,000	[3] 101,716,000
Value per ton received by producers:						
White lead (dry)	$154	$159	[2] $207	$308	$363	$351
Red lead	162	168	196	333	396	333
Litharge	142	148	175	313	387	324
Zinc oxide	131	138	144	186	218	230
Leaded zinc oxide	125	132	143	204	245	242
Lithopone	75	78	81	105	115	115
Foreign trade:						
Lead pigments:						
Value of exports	$1,121,000	$1,427,000	$851,000	$1,041,000	$970,000	$1,157,000
Value of imports	8,000	8,000	13,000	150,000	633,000	143,000
Zinc pigments:						
Value of exports	2,521,000	2,279,000	2,911,000	6,554,000	5,229,000	3,426,000
Value of imports	17,000	(4)	9,000	31,000	7,000	52,000
Export balance	3,617,000	3,698,000	3,740,000	7,414,000	5,559,000	4,388,000

[1] Reported as sales before 1945.
[2] Data for basic lead sulfate in 1946 included under white lead; Bureau of Mines not at liberty to show separately.
[3] Excludes value of basic lead sulfate; Bureau of Mines not at liberty to publish.
[4] Less than $500.

Production and shipments of competitive titanium pigments dropped somewhat from 1948, following the establishment of five successive annual peaks; except for 1948, both items were at the highest

annual rates ever attained. At present the Bureau of Mines is not at liberty to publish figures covering pigments of this class.

Highlights in the distribution of pigments and salts covered by this report are outlined in the following discussion. Shipments of litharge for the manufacture of chrome pigments rose 15 percent in 1949 and made the only advance for pigments covered by this report. This rise, however, followed a poor showing in 1948, when it registered the sharpest percentage drop among litharge uses. The use of pigments in ceramics made conspicuous gains after 1945, but all types of pigments used for this purpose showed substantial losses in this field in 1949. Ceramics—now the second largest use of litharge—established a new peak in 1948 but dropped 33 percent in 1949, or proportionately more than any other important use. Shipments of red lead to makers of ceramics fell more than any other class and amounted to less than one-half of the 1948 tonnage. The use of zinc oxide in ceramics established three successive peaks in 1946, 1947, and 1948 but was reduced 43 percent in 1949 as compared with 27 percent for total zinc-oxide shipments. Zinc oxide and red lead shipped for paint manufacture fared better than other pigments shipped for this purpose. Rubber took proportionately more lithopone in 1949 than in 1948 and except for

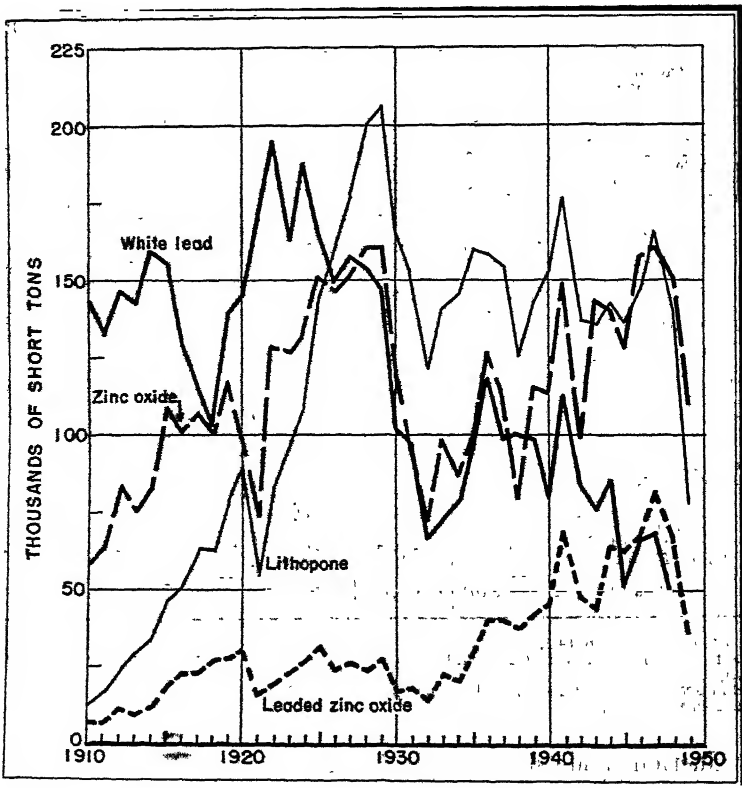

FIGURE 1.—Trends in shipments of white pigments, 1910–49.

1948 used more than in any year since 1941. Shipments of zinc oxide and lithopone for coated fabrics were in contrast in 1949, those of the former falling proportionately more and of the latter less than total shipments of these two classes of pigments. Floor coverings took much less of both pigments in 1949, zinc-oxide shipments falling a much higher percentage than total shipments.

Zinc sulfate made the best showing of the products covered by this report, chiefly because of record-breaking shipments for rayon manufacture, the gain being 9 percent (dry basis) over the previous peak in 1948. The agricultural use, which led all others in 1946, took less than one-half as much as rayon in 1949.

PRODUCTION

The value of lead and zinc pigments in 1949 (exclusive of that for basic lead sulfate, which cannot be shown) was $101,716,000, a decrease of 35 percent compared with a 32-percent decline during 1949 in the total tonnage of the lead and zinc pigments covered. Lead pigments and zinc pigments comprised 58 and 42 percent, respectively, of the total value in 1949 as in 1948.

For many years, figures on sales were used in this series of reports as a better guide than production to activity in the pigments industry. Beginning with 1945, the base was changed to shipments to conform with data compiled on Bureau of Mines lead and zinc schedules. Available information for 1945 (the year of change) indicated that there was little difference between sales and shipments in that year. In reporting tonnages of pigments, an attempt is made to avoid all duplication; one of the chief problems is that finished pigments frequently are blended to make another product. Basic lead sulfate and zinc oxide, for example, are blended to make leaded zinc oxide, and in this instance the pigment weights appear in the total for the last-named class only. Pigments consumed by producing companies to make products beyond those covered by this report—that is, paints, storage batteries, and other articles—are considered as shipments.

LEAD PIGMENTS

Shipments of lead pigments dropped 25 percent in quantity and 36 percent in value in 1949 as compared with 1948. The smaller average values received by producers for all but white lead in oil, which rose slightly, explain the greater decrease in total value than in total quantity. (Shipments of basic lead sulfate, which the Bureau of Mines is not at liberty to publish, are excluded from the figures shown.) All lead pigments covered by this report fell in 1949—shipments of white lead, dry, dropping 41 percent, the in-oil variety 40 percent, litharge 22, and red lead 19.

Quoted prices for lead pigments dropped substantially during the year from the all-time peaks at the year's beginning; average values reported by producers fell 16 percent for both red lead and litharge and 3 percent for white lead (dry), whereas that for the in-oil variety gained 1 percent.

Production and shipments of lead pigments [1] in the United States, 1948–49

Pigment [1]	1948 Production (short tons)	1948 Shipments: Short tons	1948 Shipments: Value [2] Total	1948 Shipments: Value [2] Average	1949 Production (short tons)	1949 Shipments: Short tons	1949 Shipments: Value [2] Total	1949 Shipments: Value [2] Average
White lead:								
Dry	25,955	26,551	$9,643,402	$363	15,609	15,719	$5,520,250	$351
In oil [3]	17,672	19,519	9,129,237	468	11,187	11,636	5,504,207	473
Red lead	29,698	30,787	12,190,258	396	26,362	24,866	8,276,801	333
Litharge	159,489	154,775	59,952,202	387	123,157	121,052	39,262,768	324

[1] Bureau of Mines not at liberty to publish figures for basic lead sulfate (sublimed lead).
[2] At plant, exclusive of container.
[3] Weight of white lead only but value of paste.

Lead pigments shipped [1] in the United States, 1910–49, in short tons

Year	White lead: Dry	White lead: In oil	White lead: Total	Basic lead sulfate (sublimed lead): White	Basic lead sulfate (sublimed lead): Blue	Red lead	Orange mineral	Litharge
1910	32,237	111,573	143,810	9,858		[2] 19,801	[2] 676	23,742
1911	25,834	106,778	132,612	10,019		[2] 19,540	[2] 766	25,190
1912	26,242	120,591	146,833	11,085		[2] 21,120	[2] 545	29,111
1913	24,196	118,430	142,626	12,452		[2] 17,635	[2] 434	23,093
1914	29,076	130,398	159,474	12,665		[2] 18,697	[2] 426	27,345
1915	33,907	122,194	156,101	13,364		[3] 19,435	(3)	26,118
1916	32,938	96,041	128,979	10,977	1,287	[3] 23,035	(3)	37,739
1917	27,869	87,331	115,200	8,231	1,369	[3] 25,478	(3)	44,102
1918	20,089	82,799	102,888	7,403	1,343	[3] 30,069	(3)	48,874
1919	30,085	109,005	139,090	9,068	1,350	[3] 32,362	(3)	46,739
1920	33,678	112,017	145,695	12,412	928	[3] 34,431	(3)	62,329
1921	26,738	143,545	170,283	11,568	463	21,805	381	41,909
1922	41,598	153,393	194,991	13,765	972	30,509	370	58,261
1923	37,786	125,087	162,873	11,949	800	38,037	646	75,107
1924	42,622	144,872	187,494	14,572	1,088	36,813	331	74,724
1925	43,426	120,479	163,905	14,996	1,090	41,669	840	86,546
1926	37,968	111,845	149,813	12,271	1,236	42,550	813	82,540
1927	38,669	119,026	157,695	13,482	1,061	39,073	709	81,655
1928	42,049	111,923	153,972	16,002	1,234	40,497	459	85,570
1929	42,159	104,872	147,031	15,580	1,234	43,021	678	87,916
1930	32,548	69,592	102,140	10,308	1,219	32,941	356	72,578
1931	30,922	66,446	97,368	8,790	896	25,853	282	63,890
1932	19,946	46,728	66,674	5,708	549	18,880	212	58,096
1933	24,628	48,354	72,982	7,320	625	21,988	231	61,193
1934	22,569	56,165	78,734	6,399	668	26,743	234	68,733
1935	27,972	68,859	96,831	7,572	727	28,776	252	79,930
1936	34,775	83,632	118,407	7,531	891	34,896	248	86,246
1937	32,661	65,552	98,213	7,514	1,108	33,931	206	83,902
1938	29,813	70,400	100,213	5,030	771	30,183	127	68,711
1939	30,509	67,920	98,429	4,688	850	39,976	131	89,518
1940	30,115	50,447	80,562	5,493	707	42,200	137	89,841
1941	54,689	58,311	113,000	8,739	1,631	53,838	246	122,280
1942	35,865	47,774	83,639	7,229	1,181	48,369	128	91,513
1943	39,525	36,642	76,167	4,752	845	53,378	79	113,091
1944	46,466	39,260	85,726	5,253	1,080	53,972	284	138,203
1945	27,382	23,788	51,170	2,235	1,660	47,381	230	138,798
1946	[4] 41,892	24,609	[4] 66,501	(4)	(4)	32,526	123	133,799
1947	39,075	29,712	68,787	(5)	(5)	36,064	----------	167,050
1948	26,551	19,519	46,070	(5)	(5)	30,787	----------	154,775
1949	15,719	11,636	27,355	(5)	(5)	24,866	----------	121,052

[1] Reported as sales before 1945.
[2] Small quantity of orange mineral included with red lead.
[3] Orange mineral included with red lead.
[4] Basic lead sulfate included with white lead (dry); Bureau of Mines not at liberty to publish figure.
[5] Bureau of Mines not at liberty to publish figure.

White Lead.—The downtrend in shipments of white lead, both the dry and in-oil varieties, continued in 1949, and shipments of both varieties were the smallest by far since considerably before the beginning of the present century. The all-time record prices for pig lead in 1947 and 1948, due to stringent supplies of this raw material, were a major factor in sharp extension of the downward movement.

Basic Lead Sulfate.—The Bureau of Mines is not at liberty to publish figures on basic lead sulfate for 1946–49.

Red Lead.—Red-lead shipments fell 19 percent from 1948 and were the smallest since 1933. Nonetheless, red lead had the smallest decline of the pigments covered by this report.

Orange Mineral.—No shipments nor production of orange mineral were reported in 1947–49.

Litharge.—Shipments of litharge dropped 22 percent in 1949 and were the smallest since 1943. Shipments of this pigment, however, were at a higher level than in any year before 1941 and thus ranked highest of the pigments covered by this report.

Lead Suboxide.—Battery manufacturers produced 55,000 short tons of black suboxide of lead for their own use in 1949. This quantity was 20 percent below the high record established in 1947 and continued in 1948. Black oxide production required 53,000 tons of pig lead in 1949 and 66,000 tons in both 1948 and 1947.

ZINC PIGMENTS AND SALTS

Shipments of zinc pigments declined 37 percent in quantity and 34 percent in value in 1949 as compared with 1948; the drop in value was from an all-time peak. All pigments covered shared the decrease—lead-free zinc oxide fell 27 percent, the leaded class 46 percent, and lithopone 44 percent. An increase in the average value received for zinc oxide—the largest tonnage pigment—accounted for the smaller decline in total value than in total quantity. Quoted prices, like those for lead pigments, dropped during 1949 from the high levels prevailing when the year began.

Production and shipments of zinc pigments and salts in the United States, 1948–49

Pigment or salt	1948				1949			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Short tons	Value [1]			Short tons	Value [1]	
			Total	Average			Total	Average
Zinc oxide [2]	146,565	150,958	$32,862,368	$218	109,126	110,132	$25,299,970	$230
Leaded zinc oxide [2]	67,480	67,441	16,548,636	245	37,046	36,722	8,874,695	242
Lithopone	151,005	140,033	16,135,976	115	72,233	78,335	8,977,178	115
Zinc chloride, 50° B	67,908	68,701	4,717,963	69	55,197	55,208	3,857,386	70
Zinc sulfate	20,125	21,513	2,443,869	114	20,952	20,065	2,365,120	118

[1] Value at plant, exclusive of container.
[2] Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide. In this table data for leaded zinc oxide include a small quantity containing less than 5 percent lead.

Zinc chloride shipments were 20 percent lower than in 1948, believed to be the all-time record. The average value was slightly higher in

1949. Zinc sulfate shipments had a 7-percent drop—the smallest decline of the products covered by this report. The average value received by producers rose 4 percent in 1949.

Zinc pigments and salts shipped [1] in the United States, 1910–49, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° B.)	Zinc sulfate
1910	58,481	6,823	12,655		
1911	63,827	6,765	16,866		
1912	84,002	11,410	24,220		
1913	75,700	9,421	29,685		
1914	82,809	11,317	32,819	(2)	(2)
1915	109,261	18,758	46,494		
1916	100,339	23,003	51,291		
1917	107,586	23,450	63,713		
1918	100,286	26,714	62,403		
1919	117,639	27,591	78,365	[3] 59,228	[3] 2,763
1920	99,444	30,460	89,373	[3] 68,945	[3] 3,072
1921	74,329	16,103	55,016	59,457	3,295
1922	128,465	19,613	83,360	41,627	5,078
1923	126,987	23,504	98,199	42,431	5,375
1924	131,470	26,729	109,469	51,054	4,674
1925	151,354	31,750	145,019	45,619	5,593
1926	146,923	23,859	159,931	47,296	6,612
1927	151,246	26,064	176,994	40,141	6,418
1928	160,904	24,223	200,468	45,669	4,733
1929	160,611	27,149	206,315	43,189	7,454
1930	119,142	17,279	164,065	29,043	6,249
1931	95,700	18,577	151,850	34,885	5,290
1932	72,250	14,305	121,667	23,524	4,252
1933	98,542	22,868	140,831	32,187	5,698
1934	87,088	20,506	145,565	19,614	7,379
1935	99,697	29,976	159,486	(4)	7,892
1936	126,800	40,512	158,319	(4)	9,721
1937	114,652	40,343	154,771	(4)	10,521
1938	79,129	38,216	125,746	(4)	7,757
1939	114,552	42,684	142,759	(4)	10,157
1940	113,213	45,362	151,802	(4)	11,937
1941	148,833	68,920	176,642	(4)	19,201
1942	99,677	48,128	137,320	52,374	14,331
1943	143,402	43,828	135,723	53,707	15,649
1944	140,675	64,395	142,905	57,545	17,156
1945	127,955	62,598	136,161	56,230	20,854
1946	157,851	67,971	147,001	57,316	24,931
1947	160,771	81,459	165,024	65,521	21,547
1948	150,958	67,441	140,033	68,701	21,513
1949	110,132	36,722	78,335	55,208	20,065

[1] Reported as sales before 1945.
[2] No canvass.
[3] Figures represent production.
[4] Data not available.

Zinc Oxide.—Production of lead-free zinc oxide totaled 109,126 tons, or 26 percent less than for 1948. Lead-free zinc oxide shipments dropped 27 percent in 1949 and were the smallest since 1942, when the output was affected adversely by stringent supplies of zinc metal and scrap. Production in 1949 was curtailed by the labor strike beginning September 26 and lasting beyond the end of the year at the Palmerton, Pa., plant of the New Jersey Zinc Co.

Production of zinc oxide (lead-free) by processes, 1944–49, in percent of total

Process	1944 [1]	1945 [1]	1946 [1]	1947	1948	1949
American process (ore and primary residues)	77	77	75	73	76	71
French process (metal and scrap)	16	15	17	17	15	17
Other	7	8	8	10	9	12
Total	100	100	100	100	100	100

[1] Revised figures.

Leaded Zinc Oxide.—The 1949 production of leaded zinc oxide was reported, by grades, as follows (comparison with 1948 in parentheses): 31,434 (53,915) tons of 35 percent lead and under, and 5,612 (13,565) tons of over 35 percent lead. The strike at the Palmerton, Pa., plant of the New Jersey Zinc Co., already mentioned under Zinc Oxide, likewise curtailed output of the leaded variety.

Leaded zinc oxide shipments fell 46 percent in 1949, following a long period, roughly coinciding with the beginning of World War II through 1948, during which peak or near peak tonnages were distributed. The good performance during the years before 1949 was permitted by the fact that leaded zinc oxide is made largely from ores, so that inadequate supplies of metal and scrap during the period under discussion did not militate against the manufacture of this pigment.

Lithopone.—Lithopone fared worse in 1949 than most other pigments covered by this report. Shipments dropped 44 percent—a smaller percentage than those of leaded zinc oxide—but were the lowest since 1921 and only 38 percent of the peak shipments in 1929. Plant capacity for the manufacture of lithopone was reported to be 157,000 short tons in 1949, unchanged from 1948 and 1947.

The lithopone statistics in this report are given on the basis of ordinary lithopone sold as such plus the ordinary lithopone content of the high-strength product. This method of publication is used to conceal the operations of one company that always dominates the output of the high-strength product and has been the only producer in some years. In 1949, as in 1948 and 1947, one company operating two plants produced high-strength lithopone. Consumption of ordinary lithopone in the manufacture of titanated lithopone has dropped to very small proportions. The trend has been downward almost continuously since the peak—19,400 tons—was used in 1937. In 1949 the tonnage was unchanged from the small total for 1948. The lithopone figures in the following table are included in the totals for ordinary lithopone in other tables.

Titanated lithopone produced in the United States and ordinary lithopone used in its manufacture, 1940–44 (average) and 1945–49, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	Year	Titanated lithopone produced	Ordinary lithopone used
1940–44 (average)	13,240	11,180	1947	2,600	2,200
1945	9,200	7,800	1948	2,100	1,700
1946	7,500	6,350	1949	2,000	1,700

Zinc Sulfide.—In 1949, as in several preceding years, only one company produced zinc sulfide; the Bureau of Mines is not at liberty to publish figures for this pigment.

Zinc Chloride.—Zinc chloride shipments (50° B. solution) dropped 20 percent in 1949 from 1948 (believed to have been the all-time peak). The figures shown here include the zinc chloride equivalent of zinc ammonium and chromated zinc chloride produced.

Zinc Sulfate.—Shipments of zinc sulfate decreased 7 percent in 1949, the smallest decline in the products covered by this report. The tonnages for 1948 and 1947, almost identical, were second only to the all-time record established in 1946.

RAW MATERIALS USED

Figures covering the raw materials used in making pigments and salts in 1949 and 1948 are shown in the accompanying tables.

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and such secondary materials as scrap. In 1949 roughly 94 (92 in 1948) percent of the lead in pigments was derived from pig lead and the remainder from ore. Of the lead in ore used to make leaded zinc oxide, about 6 (7) percent was from foreign sources. The proportion for zinc pigments in 1949 was 72 (73) percent from ore and concentrates, 8 (8) percent from slab zinc, and 20 (19) percent from secondary materials; about 18 (19) percent of the ore used was foreign.

The following tables give the source of the metal used in manufacturing each pigment and salt. Pig lead is employed exclusively, either directly or indirectly, in the manufacture of white lead, litharge, red lead, and orange mineral and is used also in the manufacture of basic lead sulfate. The lead content of leaded zinc oxide made from basic lead sulfate, which in turn was made from pig lead, is credited to pig lead in the table. Zinc oxide is the only pigment in which considerable slab zinc is used. Ore is employed in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulfide, zinc sulfate, and basic lead sulfate. A substantial proportion of the zinc in lithopone (65 percent in 1949 and 63 in 1948) and most of that in zinc chloride (all in 1949 and 1948) made in the United States are derived from secondary material. For a number of years before the United States entered the recent World War, there had been a large increase in the quantity of secondary zinc used in the manufacture of zinc oxide. The scarcity of supplies of both metal and scrap caused the proportion of the total oxide made by the French process, which uses only metal and scrap, to drop sharply in 1942 and to continue comparatively low in 1943–46, despite the fact that the percentage from metal and scrap rose in 1943 and continued upward almost without interruption in 1944–49. The production of zinc oxide from metal and scrap accounted for the following percentages in relation to total production: 41 percent in 1939, 16 percent in 1942, 19 percent in 1943, 22 percent in 1944, 25 percent in 1945, 26 percent in 1946, 28 percent in 1947, 26 percent in 1948, and 29 percent in 1949.

Lead content of lead and zinc pigments produced by domestic manufacturers, by sources, 1948–49, in short tons

Pigment	1948				1949			
	Lead in pigments produced from—			Total lead in pigments	Lead in pigments produced from—			Total lead in pigments
	Ore		Pig lead		Ore		Pig lead	
	Domestic	Foreign			Domestic	Foreign		
White lead			35,011	35,011			21,504	21,504
Red lead			26,924	26,924			23,900	23,900
Litharge			148,038	148,038			114,314	114,314
Leaded zinc oxide	16,639	1,261		17,900	8,835	555		9,390
Total [1]	16,639	1,261	209,973	227,873	8,835	555	159,718	169,108

[1] Excludes lead in basic lead sulfate, data for which Bureau of Mines not at liberty to publish.

Zinc content of zinc pigments and salts produced by domestic manufacturers, by sources, 1948–49, in short tons

Pigment or salt	1948					1949				
	Zinc in pigments and salts produced from—				Total zinc in pigments and salts	Zinc in pigments and salts produced from—				Total zinc in pigments and salts
	Ore		Slab zinc	Secondary material [1]		Ore		Slab zinc	Secondary material [1]	
	Domestic	Foreign				Domestic	Foreign			
Zinc oxide	64,880	21,708	15,185	15,483	117,256	48,715	13,534	10,171	14,676	87,096
Leaded zinc oxide	30,472	2,616			33,088	17,747	1,183			18,930
Lithopone	9,741	1,065	8	18,775	29,589	4,159	723	9	9,118	14,009
Total pigments [2]	105,093	25,389	15,193	34,258	179,933	70,621	15,440	10,180	23,794	120,035
Zinc chloride				14,965	14,965				12,157	12,157
Zinc sulfate	2,066	101	30	3,916	6,113	2,003	78		4,464	6,545

[1] These figures are higher than those shown in the report on Secondary Metals—Nonferrous because they include zinc recovered from byproduct sludges, residues, etc., not classified as purchased scrap material.
[2] Excludes zinc sulfide, data for which Bureau of Mines not at liberty to publish.

CONSUMPTION AND USES

LEAD PIGMENTS

White Lead.—A large part of the shipments of white lead reported was not classified as to destination; as a consequence, only 63 percent is shown as going to paint manufacturers. Doubtless the customary 90-plus percent actually was used to make paint in 1949. Shipments of white lead to makers of ceramics declined again in 1949 and were not much more than half of the tonnage for 1947.

Distribution of white lead (dry and in oil) shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940-44 (average) [1]	1945	1946 [2]	1947	1948	1949
Paints	79,406	46,418	60,943	61,265	40,892	17,350
Ceramics	2,187	839	1,367	1,665	1,369	894
Unclassified	6,226	3,913	4,191	5,857	3,809	9,111
Total	87,819	51,170	66,501	68,787	46,070	27,355

[1] Reported as sales.
[2] Data for basic lead sulfate included with white lead; Bureau of Mines not at liberty to show separately.

Basic Lead Sulfate.—A distribution of basic lead sulfate shipments by uses has not been available for publication since that for 1945, when 3,009 short tons went to the paint industry, 200 tons to the rubber industry, and 686 tons to other industries. Substantial quantities of lead sulfate are also used as an intermediate product in the manufacture of leaded zinc oxide. Such quantities have always been shown in this chapter series under leaded zinc oxide rather than basic lead sulfate.

Red Lead.—Storage batteries, regularly the principal use of red lead, took 49 percent of the total shipped in 1949 but dropped proportionately more than paints, second in importance. Ceramics, which

had been gaining, had the sharpest drop, falling to less than half of the 1948 tonnage.

According to a recent study [1] by the Battelle Memorial Institute for the American Iron and Steel Institute, red lead appears to be outstanding for enclosed structural members in steel-housing construction. Some 34 kinds of paint systems were studied during the test. In one phase of the testing, one painted panel was damaged by scratching it lengthwise through the paint film to base metal. In the case of damaged films exposed to immersion in water, "only System C (red lead) offered protection to the bare steel in the damaged zone. In fact, for the majority of the other systems, continued exposure would have resulted in actual perforation of the base metal in this area in a relatively short period of time."

Distribution of red-lead shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average) [1]	1945	1946	1947	1948	1949
Storage batteries	26,899	26,725	19,115	20,883	14,854	12,163
Paints	18,688	16,438	9,318	11,362	10,863	9,634
Ceramics	1,030	626	1,228	977	1,275	603
Other	3,734	3,592	2,865	2,842	3,795	2,466
Total	50,351	47,381	32,526	36,064	30,787	24,866

[1] Reported as sales.

Orange Mineral.—No shipments of orange mineral have been reported since 1946, when 78 short tons went to the ink industry, 18 tons to the color-pigment industry, and 27 tons to other industries.

Litharge.—Storage batteries took 64 percent of the litharge shipped in 1949 and 65 percent in 1948. Ceramics dropped proportionately more than other uses and accounted for 11 percent of the 1949 total, compared with 13 percent. The manufacture of chrome pigments was the only use that increased in 1949, rising 15 percent; this use took 7 percent of the total, compared with 5 percent in 1948. Chrome pigments had the sharpest percentage drop in 1948. Oil refining and

Distribution of litharge shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average) [1]	1945	1946	1947	1948	1949
Storage batteries	51,821	79,981	75,836	111,840	100,645	77,163
Ceramics	12,426	11,511	13,166	18,360	19,979	13,299
Chrome pigments	9,462	11,394	10,877	9,228	7,455	8,557
Oil refining	5,846	6,419	6,682	7,688	7,248	5,720
Insecticides	19,293	18,061	14,259	7,288	6,083	5,353
Varnish	3,207	2,752	3,302	4,258	4,424	4,286
Rubber	3,289	1,864	2,131	2,205	2,835	1,398
Floor coverings	325	115	106	141	152	62
Other	5,337	6,701	7,440	6,042	6,004	5,214
Total	110,986	138,798	133,799	167,050	154,775	121,052

[1] Reported as sales.

[1] Pray, H. A., and Peoples, R. S., No. 31 of a series entitled "Contributions to the Metallurgy of Steel": Abs. in Am. Metal Market, vol. 54, No. 204, Oct. 21, 1949, p. 7.

insecticides maintained their same relative standings in 1949 as in 1948, taking 5 and 4 percent, respectively, of the total shipped. Varnish took 4 compared with 3 percent. Rubber manufacture and floor coverings had the greatest percentage drops, both falling to less than half of the 1948 quantities.

Lead Suboxide.—Storage-battery manufacturers themselves produce from pig lead a black suboxide of lead, which they use as a substitute for litharge. As previously noted, production in 1949 was 55,000 short tons, a fifth less than in the peak year 1947.

ZINC PIGMENTS AND SALTS

Zinc Oxide.—As usual, the manufacture of rubber took more than half of the zinc oxide shipped—53 percent in 1949 compared with 55 percent in 1948—indicating a slightly greater drop in the most important use than in the total distributed. The manufacture of paint decreased only 2 percent in 1949 and was less affected by the drop in zinc oxide shipments than any of the other uses. The use of zinc oxide for ceramics had established new peaks for 3 successive years ended in 1948. This use, coated fabrics and textiles, and floor coverings had declined considerably above that for total shipments, or 43, 45, and 46 percent, respectively.

Distribution of zinc oxide shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average)[1]	1945	1946	1947	1948	1949
Rubber	68,308	63,447	83,776	82,248	82,895	58,496
Paints	26,709	28,014	34,785	32,867	26,779	26,205
Ceramics	4,948	5,086	9,056	11,350	12,327	6,982
Coated fabrics and textiles[2]	6,633	12,177	10,022	9,100	9,474	5,200
Floor coverings			2,848	4,735	4,938	2,665
Chemical warfare	9,897	2,053				
Other	12,665	17,178	17.364	20,471	14,545	10,584
Total	129,160	127,955	157,851	160,771	150,958	110,132

[1] Reported as sales.
[2] Includes the following tonnages for rayon: 1946—9,363; 1947—7.302; 1948—8.209; 1949—4,470.

Leaded Zinc Oxide.—Leaded zinc oxide is used almost exclusively in the manufacture of paint, and 98 percent of the shipments in 1949 were reported to be for this purpose.

Distribution of leaded zinc oxide shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average)[1]	1945	1946	1947	1948	1949
Paints	52,678	58,852	64,816	77,994	64,912	35,938
Rubber	33	200	166	131	218	124
Other	1,416	3,546	2,989	3,334	2,311	660
Total	54,127	62,598	67,971	81,459	67,441	36,722

[1] Reported as sales.

Lithopone.—Paints, varnish, and lacquers regularly take close to three-quarters of the total lithopone sold. In 1949, 72 percent of shipments was for paints, etc., compared with 75 percent in 1948 and 82 percent in 1947. Paints, etc., took 46 percent less lithopone in 1949 than in 1948 and amounted to less than half of the totals for 1947 and 1946. Coated fabrics and textiles fell only 22 percent in 1949 and moved into second place as users of lithopone, replacing floor coverings, which dropped 49 percent. Consumption for rubber was 23 percent below 1948 but was higher than in every other year since 1941. The use of lithopone by paper makers rose from 3,086 tons in 1945 to 4,814 in 1948 but dropped to less than half of the latter quantity in 1949. Printing ink made the best showing of the uses of lithopone, with a drop of only 18 percent in 1949; 593 tons were shipped for this purpose compared with 727 in 1948, 720 in 1947, 830 in 1946, 864 in 1945, and 1,216 in 1944. One manufacturer regularly includes tonnages for ink as not separable from those sold for paint, but the foregoing tonnages compare totals for identical companies. Exports are included mainly with "Other," but at least one company classifies part of its exports according to end use.

Distribution of lithopone shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average) [1]	1945	1946	1947	1948	1949
Paints, varnishes, and lacquers [2]	114,328	109,398	123,279	134,830	104,441	56,146
Floor coverings and textiles	17,274	15,821	15,167	17,469	20,859	12,982
Rubber	1,957	977	1,607	3,085	4,192	3,245
Other	15,319	9,965	6,948	9,640	10,541	5,962
Total	148,878	136,161	147,001	165,024	140,033	78,335

[1] Reported as sales.
[2] Includes a quantity, not separable, used for printing ink.

Zinc Chloride.—Statistics on the use and distribution of zinc chloride are not available. Studies of the effectiveness of zinc chloride and other chemicals in the treatment of mine timbers were summarized [2] recently. The report stated:

> In a service test of maple timbers treated by the hot- and cold-bath method and installed in main haulageways of the Athens mine of the Cleveland Cliffs Iron Co., Negaunee, Mich., zinc chloride-treated timbers had an average useful life of 13.3 years; borax-treated timbers, 11.2 years; and sodium-fluoride-treated timbers, 7.7 years. Untreated timbers used as controls had an average useful life of 3.8 years.
>
> Although it was intended in this experiment to compare the relative effectiveness of zinc chloride, borax, and sodium fluoride, the wide variations in absorptions and penetrations obtained with the three chemicals invalidate such comparison. The zinc chloride absorptions were about as desired, but the absorptions of borax and sodium fluoride (especially the latter) were too low. Although retention of these two chemicals was low, the timbers treated with them, as well as those treated with zinc chloride, proved to be longer-lived and more economical than the untreated timbers used in the test.

[2] Crawford, F. S., and Wirka, R. M., A Test of Treated Timbers in a Mine at Negaunee, Mich.: Bureau of Mines Rept. of Investigations 4622, 1950, 6 pp.

Research in connection with flame-proofing textiles was summarized[3] recently. The article gives an evaluation of several pigment-resin-type treated fabrics. One chemical combination used contained zinc chloride and another, zinc oxide.

Zinc Sulfate.—Rayon, the chief use for zinc sulfate in the past 3 years, established a new peak in 1949, rising 9 percent (dry basis) over the previous high in 1948. Shipments for agricultural purposes—the top use in 1946 when it was at a peak level—amounted to less than half of the quantity for rayon, having fallen 15 percent from 1948 and 56 percent from 1946. Chemicals and flotation reagents dropped 29 and 45 percent, respectively, the former having fallen even more sharply from tonnages for earlier years, whereas the latter compared favorably with years before 1948. However, the apparent decline in importance of zinc sulfate in chemicals may simply be a result of more precise data on shipments by uses. Contrary to the trend for most other uses, paints and varnish processing rose substantially in 1949. This use dropped notably in 1946; the 1949 increase marked resumption of the 1945 level of use.

Distribution of zinc sulfate shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average)[1]	1945	1946		1947		1948		1949	
	Gross weight	Gross weight	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis
Rayon	4,492	6,729	7,634	5,883	8,210	6,173	9,900	7,333	10,591	7,957
Agriculture	3,566	6,645	10,816	8,178	7,827	6,125	5,210	4,248	4,429	3,595
Chemicals	2,680	2,617	2,254	1,488	2,120	1,439	1,734	1,193	1,197	851
Flotation reagents	664	1,232	1,084	643	1,112	717	1,632	1,366	921	757
Paints and varnish processing	1,723	589	174	151	61	51	121	104	663	585
Glue	640	260	511	335	624	444	561	462	453	370
Electrogalvanizing	307	255	488	315	233	146	319	205	217	154
Textile dyeing and printing	92	534	552	491	60	38	102	66	30	21
Other	1,491	1,993	1,418	943	1,300	864	1,934	1,191	1,564	979
Total	15,655	20,854	24,931	18,427	21,547	15,997	21,513	16,168	20,065	15,269

[1] Reported as sales.

PRICES

Total and average values received by producers for lead and zinc pigments and zinc salts are given in the tables in the first part of this report. Following two successive years (1947 and 1948) in which new peaks in average values for lead pigments were established, values dropped in 1949; the declines ranged from 16 percent for red lead and litharge to 3 percent for white lead (dry). Zinc average values likewise were at peaks for many years and in some instances perhaps for all time in the 2 years, but, except for leaded zinc oxide, were unlike those for lead pigments in 1949 and showed small gains. Total values of both types dropped substantially in 1949 owing chiefly to the smaller tonnages involved. The small gains in zinc-pigment average

[3] Church, James M., Little, Robt. W., and Coppick, Sydney, Evaluation of Flame-Resistant Fabrics; Ind. and Eng. Chem., vol. 42, No. 3, March 1950, pp. 418–427.

values probably indicate that sales during the year were greater at the higher part of the price range.

There were substantial drops in average quoted prices for lead pigments in 1949 from the all-time peaks established in 1948, and those for zinc pigments in general followed the same pattern. In most instances lead-pigment prices were at their lowest levels in June, made noteworthy recovery in the next several months, and returned to or close to midyear low points in December. Zinc-pigment quotations reached their lowest levels a little later in the year and after recoveries similar to those for the lead group resumed down trends but ended the year a little above the year's lowest figures.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1946–49, in cents per pound

[Oil, Paint and Drug Reporter]

Product	1946	1947	1948	1949
White lead (basic lead carbonate), dry, carlots, barrels	8.25–13.75	13.75–16.00	[1] 16.00–22.10	[1] 14.75–22.10
Basic lead sulfate (sublimed lead), less than carlots, barrels	7.50–13.50	13.25–15.75	15.75–21.25	14.25–21.25
Red lead, dry, 95 percent or less, less than carlots, barrels	9.50–16.00	15.75–18.60	18.00–25.25	15.75–25.25
Orange mineral, American, small lots, barrels	12.00–18.25	17.75–21.00	20.50–27.60	18.10–27.60
Litharge, commercial, powdered, barrels	8.00–14.75	13.75–17.60	16.60–24.25	13.75–24.25
Zinc oxide:				
American process, lead free, bags, carlots	7.25– 9.00	9.00–10.00	10.00–13.50	10.00–15.50
American process, 5 to 35 percent lead, barrels, carlots	7.25–10.75	9.25–12.00	10.25–15.38	10.25–17.38
French process, red seal, bags, carlots	8.50–10.25	10.25–11.25	11.25–14.75	11.50–16.75
French process, green seal, bags, carlots	9.00–10.57	10.75–11.75	11.75–15.25	11.75–17.25
French process, white seal, barrels, carlots	9.75–12.00	11.50–12.50	12.50–16.00	12.50–18.00
Lithopone, ordinary, small lots, bags	4.50– 5.25	5.25– 6.25	6.25– 6.75	6.50– 6.75
Zinc sulfide, less than carlots, bags, barrels	8.50–10.00	10.00–11.00	10.75–14.00	12.50–14.00
Zinc chloride, works:				
Solution, tanks	2.50	2.50– 3.00	3.00– 3.25	3.25
Fused, drums	5.00– 6.50	5.00– 7.40	6.25– 7.90	6.75– 8.15
Zinc sulfate, crystals, barrels	3.65– 4.40	3.65– 5.00	4.55– 6.85	4.95– 6.85

[1] Quotations for bags.

FOREIGN TRADE [1]

Imports of lead and zinc pigments are insignificant in relation to domestic shipments of the various items. Total value of lead-pigment entries, following a substantial percentage rise in 1948, dropped 77 percent in 1949 to close to the 1947 level. The declines were due to lower tonnages rather than to falling average values, despite the fact that prices were substantially lower at the end than at the beginning of the year. Imports of zinc pigments rose sharply in 1949 but were scarcely one-third of the total value of lead-pigments receipts.

The total value of exports of lead pigments gained and that of zinc pigments fell in 1949. Values of both classes were far in excess of corresponding imports but were small as compared with domestic shipments.

Values of both imports and exports of the lead and zinc compounds covered by the accompanying table dropped in 1949.

In quantity as well as value, exports of lithopone and of zinc oxide

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

are the most important items in foreign trade in lead and zinc pigments and zinc salts. Both classes dropped in quantity and in value in 1949.

Value of foreign trade of the United States in lead and zinc pigments and salts, 1947–49

[U. S. Department of Commerce]

	Imports			Exports		
	1947	1948	1949	1947	1948	1949
Lead pigments:						
White lead	$238	$82,538	$73,485	$334,631	$294,527	$276,888
Red lead	7,687	96,506	11,848	296,796	390,222	[1] 408,491
Litharge	127,375	421,595	39,822	409,417	285,473	471,143
Other lead pigments	15,060	32,689	17,448	(2)	(2)	(2)
Total	150,360	633,328	142,603	(2)	(2)	(2)
Zinc pigments:						
Zinc oxide	30,594	7,361	49,809	4,769,836	2,256,050	1,507,205
Lithopone	21		2,053	1,784,414	2,972,912	1,918,913
Total	30,615	7,361	51,862	6,554,250	5,228,962	3,426,118
Lead and zinc salts:						
Lead arsenate	20,700			591,299	433,779	186,991
Other lead compounds		448	4	(2)	(2)	(2)
Zinc chloride			2,650			
Zinc sulfate	16,867	10,397	6,472	(2)	(2)	(2)
Total	37,567	10,845	9,126	(2)	(2)	(2)
Grand total	218,542	651,534	203,591	(2)	(2)	(2)

[1] Data not strictly comparable to earlier years.
[2] Data not available.

Lead pigments and salts imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons							Total value
	White lead (basic carbonate)	Red lead	Litharge	Lead suboxide	Lead pigments n. s. p. f.	Lead arsenate	Other lead compounds	
1945	1		8	10			(1)	$7,801
1946	1	54	15	11	(1)	(1)		13,038
1947	1	22	416	33		60		171,960
1948	203	247	1,064	34	30		1	633,776
1949	161	23	96	23	6		(1)	142,607

[1] Less than 1 ton.

Zinc pigments and salts imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons						Total value
	Zinc oxide		Lithopone	Zinc sulfide	Zinc chloride	Zinc sulfate	
	Dry	In oil					
1945	(1)		(1)			421	$16,806
1946	41		(1)	(1)	2	415	26,528
1947	117	1	(1)			295	47,482
1948	27	(1)				180	17,758
1949	239	(1)	12		17	120	60,984

[1] Less than 1 ton.

Lead pigments and salts exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons						Total value
	White lead	Basic lead sulfate	Red lead	Orange mineral	Litharge	Lead arsenate	
1945	4,079	53	1,922	3	2,512	3,170	$2,162,548
1946	910	(1)	1,355	(1)	2,180	1,398	1,184,872
1947	863	(1)	787	(1)	1,212	1,552	1,632,143
1948	663	(1)	953	(1)	644	1,019	1,404,001
1949	609	(1)	1,042	(1)	1,357	430	1,343,513

[1] Figure not available.

Zinc pigments and salts exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons		Total value [1]
	Zinc oxide	Lithopone	
1945	7,102	11,576	$2,554,177
1946	10,955	9,651	2,911,457
1947	19,082	13,652	6,554,250
1948	8,642	21,015	$5,228,962
1949	5,040	14,460	3,426,118

[1] Includes also in 1945: Zinc sulfide, $25,399 (173,475 pounds); zinc chloride, $93,590 (1,499,755 pounds); zinc sulfate, $62,119 (1,243,826 pounds); other zinc salts and compounds, $179,747 (750,108 pounds). Beginning January 1, 1946, none of the foregoing classes separately recorded.

WORLD REVIEW

Canada.—A report of the Dominion Bureau of Statistics of Canada published early in 1950 gave data on pigments consumed by the paint and varnish industry in Canada in 1947 and 1948. The figures for 1948 are as follows (1947 figures for comparison in parentheses): Basic carbonate white lead (dry) 2,344 (3,264) short tons, basic carbonate white lead in oil 717 (1,741) tons, basic sulfate white lead 22 (7) tons, red lead including orange mineral 691 (625) tons, litharge 300 (312) tons, zinc oxide (lead-free) 2,975 (5,209) tons, leaded zinc oxide 2,096 (1,546) tons, lithopone (30 percent zinc sulfide) 11,851 (9,712) tons, titanium dioxide 5,766 (4,117) tons, extended titanium dioxide pigments 8,791 (7,199) tons, and "other white pigments" 590 (710) tons.

Canada's imports of lithopone, 14,787 and 12,736 tons, respectively, in 1948 and 1947, were large enough more than to cover use in the 2 years. Imports of zinc white (zinc oxide) were 1,732 and 2,205 tons, respectively. Imports of the other items given in the preceding paragraph are very small, although titanium pigments were not shown separately in the report. According to United States records for titanium dioxide and pigments, 19,787 tons were exported to Canada in 1948 and 13,274 tons in 1947.

Germany.—According to a recent article,[5] the prewar production of lithopone in all of Germany was about 100,000 tons, the greater part of the industry being located in what after the war was the British zone. The original capacity was said to be virtually intact, and maximum production could probably be obtained without much difficulty. Sales of lithopone in the American-British zones were said[6] to have decreased because of the slowing of building operations and a shortage of linseed oil. Exports, however, were said to be expanding, going largely to the Middle East, eastern Asia, the United Kingdom, and Scandinavia.

United Kingdom.—Construction of an additional unit to produce lithopone was reported[7] begun at the Widnes, Lancashire, England, plant of the Imperial Smelting Corp., Ltd.

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[5] Brennan, James V., Germany's Chemical Recovery: Abs. in Canadian Chem. and Process Ind., vol. 34, No. 2, February 1950, p. 162.
[6] Foreign Commerce Weekly, vol. 37, No. 5, Oct. 31, 1949, p. 33.
[7] Foreign Commerce Weekly, vol. 34, No. 10, Mar. 7, 1949, p. 37.

Lime[1]

By G. W. Josephson and F. D. Gradijan

GENERAL SUMMARY

THE GENERAL decline in industrial activity in 1949, particularly in the early part of the year, was reflected in reduced output of lime. Sales totaled 6,318,302 short tons, 13 percent lower than the record tonnage of 1948. Of the total sales, 73 percent were in the form of quicklime and 27 percent hydrated. The average value of quicklime per ton increased from $9.96 in 1948 to $10.48 in 1949. Hydrated-lime values rose from $11.50 in 1948 to $12.31 in 1949. The total number of active plants was virtually the same as in the previous year.

Salient statistics of the open-market lime industry in the United States, 1925–29 (average), 1935–39 (average), and 1948–49

	1925–29 (average)	1935–39 (average)	1948	1949
Active plants	419	310	181	180
Sold by producers:				
By types:				
Quicklime ... short tons	2,871,236	2,488,269	5,441,313	4,624,356
Hydrated ... do	1,585,631	1,204,128	1,822,663	1,693,946
Total lime:				
Short tons	4,456,867	3,692,397	7,263,976	6,318,302
Value [1]	$38,548,498	$26,592,115	$75,162,879	$69,319,374
Per ton	$8.65	$7.20	$10.35	$10.97
By uses:				
Agricultural ... short tons	318,224	350,535	323,300	328,528
Building ... do	2,096,744	870,335	1,140,518	1,052,097
Chemical and industrial ... do	1,623,885	1,929,947	4,255,403	3,618,969
Refractory (dead-burned dolomite) ... do	418,014	541,580	1,544,755	1,318,708
Imports for consumption ... do	18,683	14,108	35,624	34,332
Exports ... do	15,752	10,905	63,088	59,927

[1] Selling value, f. o. b. plant, excluding cost of containers.

As lime is an inexpensive commodity having wide utility, its sales are influenced by conditions in various consuming industries. Figure 1 shows the correlation between the use of open-market lime and trends in the construction industry compared with general industrial production.

Trends and sales of open-market lime sold for specified uses in the past 25 years are shown in figure 2. The trends of these curves are influenced not only by demands but also by the volume of captive lime production, the output of which is not shown in the figure.

[1] Figures in this chapter pertain to open-market lime and exclude coverage of most captive lime operations.

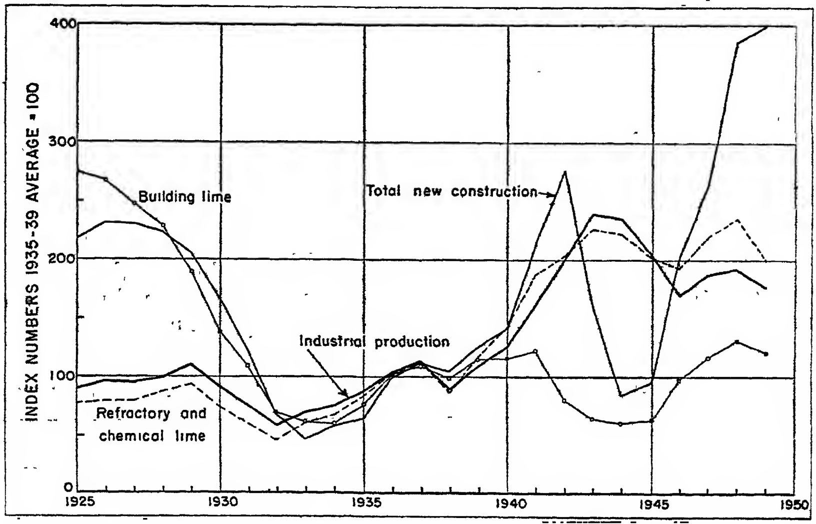

FIGURE 1.—Sales of refractory and building lime compared with total new construction and industrial production, 1925–49. Units are reduced to percentages of the 1935–39 average. Statistics on value of construction from the Bureau of Foreign and Domestic Commerce (Survey of Current Business, March 1950) and on industrial production from the Federal Reserve Board.

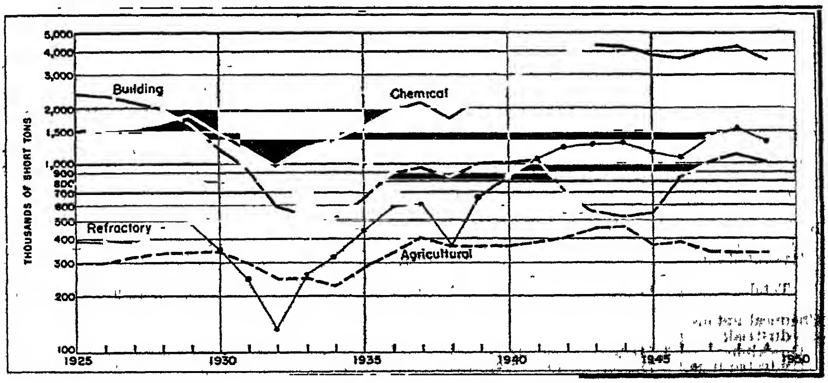

FIGURE 2.—Trends in major uses of lime, 1925–49.

DOMESTIC PRODUCTION

Total production of open-market lime (as indicated by sales) declined 13 percent in tonnage and 8 percent in value. The major declines were in refractory and in chemical and industrial lime. Both of these categories were down 15 percent. Building lime decreased 8 percent, and agricultural increased 2 percent. Stocks are said to be comparatively small and constant, so the sales statistics in this chapter are believed to be the equivalent of production of open-market lime.

Captive Tonnage.—In general, the lime statistics included in this chapter are limited to open-market lime, except that, in a few instances, a relatively small quantity of captive tonnage is included where it is particularly desirable to show complete figures for consumption by use. Specifically, in the statistics of lime sold or used in the United States in 1949, there was included a total of 355,367 short tons of captive tonnage, distributed as follows: 11,383 tons for building, 232,451 for metallurgical uses, 77,284 for miscellaneous chemical uses, and 34,249 tons of refractory lime. If it is desired to obtain a more comprehensive total for lime production, a figure of approximately the proper order of magnitude can be calculated from limestone tonnages (shown in the Stone chapter of this volume) consumed in the uses in which limestone is generally calcined.

Lime sold by producers in the United States, 1948–49, by types and major uses

	1948				1949					
	Quantity		Value [1]		Quantity		Value [1]		Percent change from 1948 in—	
	Short tons	Percent of total	Total	Average	Short tons	Percent of total	Total	Average	Tonnage	Average value
By types:										
Quicklime	5,441,313	75	$54,200,000	$9.96	4,624,356	73	$48,464,831	$10.48	−15	+5
Hydrated lime	1,822,663	25	20,962,879	11.50	1,693,946	27	20,854,543	12.31	−7	+7
Total lime [2]	7,263,976	100	75,162,879	10.35	6,318,302	100	69,319,374	10.97	−13	+6
By uses:										
Agricultural:										
Quicklime	103,039	1	932,871	9.05	111,813	2	1,063,125	9.51	+9	+5
Hydrated lime	220,261	3	2,363,200	10.73	216,715	3	2,481,195	11.45	−2	+7
Total	323,300	4	3,296,071	10.20	328,528	5	3,544,320	10.79	+2	+6
Building:										
Quicklime	251,663	4	3,230,236	12.84	223,533	4	2,849,582	12.75	−11	−1
Hydrated lime	888,855	12	10,774,041	12.12	828,564	13	10,794,161	13.03	−7	+8
Total	1,140,518	16	14,004,277	12.28	1,052,097	17	13,643,743	12.97	−8	+6
Chemical and industrial:										
Quicklime	3,541,856	49	32,189,711	9.09	2,970,302	47	28,621,898	9.64	−16	+6
Hydrated lime	713,547	10	7,825,638	10.97	648,667	10	7,579,187	11.68	−9	+6
Total	4,255,403	59	40,015,349	9.40	3,618,969	57	36,201,085	10.00	−15	+6
Refractory (dead-burned dolomite)	1,544,755	21	17,847,182	11.55	1,318,708	21	15,930,226	12.08	−15	+5

[1] Selling value, f. o. b. plant, excluding cost of container.
[2] Includes lime used by producers (captive tonnage) as follows—1948: 363,368 tons, valued at $2,843,972; 1949: 355,367 tons, $3,171,392.

Size of Plants.—In 1949 there were virtually the same number of open-market lime plants active in the United States as in 1948. Of the total 180 plants, the 38 having individual production rates greater than 50,000 tons per year contributed 71 percent of the total output.

Distribution of open-market lime (including refractory) plants, 1947–49, according to size of production

Size group (short tons)	1947			1948			1949		
	Plants	Production		Plants	Production		Plants	Production	
		Short tons	Percent of total		Short tons	Percent of total		Short tons	Percent of total
Less than 1,000	19	7,538	(1)	23	7,816	(1)	21	6,991	(1)
1,000 to less than 5,000	38	109,809	2	33	84,142	1	38	106,799	2
5,000 to less than 10,000	20	149,205	2	21	148,212	2	21	147,016	2
10,000 to less than 25,000	29	459,445	7	35	598,777	8	33	523,073	8
25,000 to less than 50,000	26	950,047	14	23	856,772	12	29	1,060,247	17
50,000 to less than 100,000	31	2,080,594	31	26	1,685,117	23	23	1,637,382	26
100,000 and over	16	3,022,341	44	20	3,883,140	54	15	2,836,794	45
Total	179	6,778,979	100	181	7,263,976	100	180	6,318,302	100

[1] Less than 0.5 percent.

PRODUCTION BY STATES

In 1949 open-market lime was produced in 32 States and 2 Territories. Ohio was the principal producer by a wide margin followed

Lime (quick and hydrated) sold by producers in the United States, 1948–49, by States

State or Territory	1948			1949		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	8	388,197	$3,275,402	8	359,446	$3,203,564
Arizona	4	54,608	763,296	4	43,529	607,709
Arkansas	1	(1)	(1)	1	(1)	(1)
California	8	179,257	3,026,941	7	153,483	2,516,262
Colorado	2	(1)	(1)	1	(1)	(1)
Connecticut	1	(1)	(1)	1	(1)	(1)
Florida	1	(1)	(1)	2	(1)	(1)
Georgia	1	6,141	58,150	1	7,028	67,252
Hawaii	1	8,767	236,799	1	8,404	226,926
Illinois	7	283,090	3,000,225	6	276,161	3,197,890
Indiana	1	(1)	(1)	1	(1)	(1)
Maine	2	(1)	(1)	2	(1)	(1)
Maryland	8	69,032	654,635	8	64,299	617,696
Massachusetts	4	112,271	1,802,251	3	107,961	1,360,328
Michigan	3	(1)	(1)	3	(1)	(1)
Minnesota	1	(1)	(1)	1	(1)	(1)
Missouri	8	1,009,993	8,998,691	8	878,561	8,035,117
Montana	2	(1)	(1)	2	(1)	(1)
Nevada	2	(1)	(1)	3	(1)	(1)
New Jersey	3	(1)	(1)	3	(1)	(1)
New York	2	(1)	(1)	2	(1)	(1)
Ohio	18	1,936,211	21,473,401	18	1,712,248	20,321,387
Oklahoma	1	(1)	(1)	1	(1)	(1)
Pennsylvania	34	1,085,807	11,319,685	34	911,065	10,190,679
Puerto Rico	5	(1)	(1)	5	7,347	184,618
South Dakota	2	(1)	(1)	1	(1)	(1)
Tennessee	5	163,098	1,442,906	6	117,053	1,108,139
Texas	8	168,738	1,583,726	8	173,724	1,739,185
Utah	4	40,635	352,859	5	86,082	355,516
Vermont	3	22,743	308,004	3	28,914	356,381
Virginia	13	382,734	3,271,058	13	349,132	3,218,897
Washington	2	(1)	(1)	2	(1)	(1)
West Virginia	6	490,803	4,610,157	6	350,311	3,535,352
Wisconsin	10	107,648	1,228,988	10	107,339	1,254,751
Undistributed [1]		754,203	8,255,710		626,245	7,226,725
Total	181	7,263,976	75,162,879	180	6,318,302	69,319,374

[1] Figures that may not be shown separately are combined as "Undistributed."

by Pennsylvania and Missouri in that order. These three States together contributed 55 percent of the United States output.

Hydrated Lime.—Most of the lime sold is in the form of quicklime, but substantial quantities are also sold in hydrated form. In 1949, 27 percent of the total lime output was sold as hydrated lime compared with 25 percent in 1948.

Hydrated lime sold by producers in the United States, 1948–49, by States

State or Territory	1948			1949		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	5	56,660	$569,539	4	40,663	$505,707
California	6	35,309	559,084	6	30,447	470,840
Georgia	1	4,965	51,409	1	7,028	67,252
Hawaii	1	8,762	236,574	1	8,403	226,881
Illinois	3	33,980	362,377	3	34,729	398,739
Maryland	5	27,186	260,401	5	22,763	223,915
Massachusetts	4	44,274	507,832	3	45,207	604,434
Missouri	5	202,143	2,064,015	6	154,626	1,663,665
Ohio	14	658,602	7,723,528	14	635,545	7,919,770
Pennsylvania	13	316,340	3,653,510	12	289,814	3,632,698
Tennessee	5	45,323	434,193	6	40,551	408,377
Texas	6	49,111	551,833	6	52,457	633,299
Vermont	1	2,765	38,710	1	5,625	71,656
Virginia	11	55,252	607,374	11	58,763	649,857
West Virginia	4	42,042	364,669	4	30,532	273,220
Other States [1]	[1] 32	239,949	2,977,831	33	236,793	3,104,233
Total	116	1,822,663	20,962,879	116	1,693,946	20,854,543

[1] Includes the following States and number of plants in 1949 (1948 same as 1949, unless shown differently in parentheses): Arizona 2, Arkansas 1, Colorado 1, Connecticut 1, Florida 1, Indiana 1, Maine 2, Michigan 1, Minnesota 1, Montana 1, Nevada 1, New Jersey 3, New York 2, Oklahoma 1, Puerto Rico 4 (3), South Dakota 0 (1), Utah 3 (2), Washington 1, and Wisconsin 6.

CONSUMPTION AND USES

The chemical and industrial uses of lime have attained great importance during recent years; but, in consonance with the moderate decline in industrial production in 1949, lime, for these uses, declined from the high level of 1948. Lime for water purification, which showed a gain of 5 percent, was the only important chemical or industrial use that increased in 1949. A small increase was recorded for agricultural lime, but building lime and that applied to refractory uses (dead-burned dolomite) experienced declines of 8 and 15 percent, respectively.

The following table of lime sales by States and uses provides geographic data that may be of interest. Although many figures are concealed to avoid revealing confidential information, the table shows, in general, the more important uses to which the lime of each State is applied and the relative importance of each State as a lime producer. The tables on sales of lime according to use indicate the great variety of uses to which lime is applied and its importance in agriculture, building construction, and industry in general.

Lime sold by producers in the United States in 1949, by States and uses

State or Territory	Agricultural		Building		Chemical and industrial										Refractory		Total	
					Metallurgical		Paper mills		Tanneries		Water purification		Other					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	47,252	$470,809	165,678	$1,273,968	75,122	$670,846	(1)	(1)	21,044	$237,791	(1)	(1)	(1)	(1)	359,446	$3,208,564
Arizona	15	$350	3,838	70,186	28,833	328,031					2,576	41,519	8,267	$167,623			43,529	607,709
Arkansas			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
California	2,540	31,436	52,713	977,523	20,437	332,033	(1)	(1)	(1)	(1)	6,676	85,515	(1)	(1)	(1)	(1)	153,483	2,516,262
Colorado			(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)			(1)	(1)
Connecticut	(1)	(1)	(1)	(1)			(1)	(1)					(1)	(1)			(1)	(1)
Florida	(1)	(1)	(1)	(1)							(1)	(1)	(1)	(1)			(1)	(1)
Georgia	760	3,712	6,268	63,540													7,028	67,252
Hawaii			878	23,724									7,526	203,202			8,404	226,926
Illinois			9,927	112,960	83,370	893,596	(1)	(1)	(1)	(1)	35,231	401,071	(1)	(1)	(1)	(1)	276,161	3,197,890
Indiana	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Maine	(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
Maryland	55,229	534,527	9,070	83,169													64,299	617,696
Massachusetts	6,840	80,808	37,036	487,895	(1)	(1)	13,441	172,249	(1)	(1)	(1)	(1)	(1)	(1)			107,931	1,360,328
Michigan			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
Minnesota	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
Missouri			66,368	693,226	147,112	1,306,070	(1)	(1)	(1)	(1)	(1)	(1)	369,596	3,030,982	(1)	(1)	878,561	8,035,117
Montana			(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)			(1)	(1)
Nevada			(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
New Jersey	(1)	(1)	(1)	(1)							(1)	(1)					(1)	(1)
New York	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
Ohio	51,724	603,555	525,357	6,713,569	64,398	640,207	28,159	278,336			(1)	(1)	(1)	(1)	807,742	10,736,135	1,712,248	20,321,387
Oklahoma			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)			(1)	(1)
Pennsylvania	136,199	1,512,069	111,278	1,566,371	200,756	2,078,389	88,570	914,265	30,758	312,158	51,231	527,789	(1)	(1)	(1)	(1)	911,065	10,190,679
Puerto Rico	(1)	(1)	(1)	(1)							(1)	(1)	(1)	(1)			7,347	184,618
South Dakota					(1)	(1)											(1)	(1)
Tennessee	845	7,468	11,583	127,947	14,532	136,472	30,457	280,045	1,917	18,258	20,562	192,907	37,207	345,042			117,053	1,108,139
Texas	250	2,338	38,429	443,706	23,850	252,217	7,713	65,024	(1)	(1)	43,625	445,652	(1)	(1)			173,724	1,739,185
Utah			1,241	23,449	33,080	298,234					(1)	(1)	(1)	(1)			36,082	355,516
Vermont	1,144	15,160	640	9,059	175	2,147	25,769	315,484	606	7,435	20	245	580	6,871			28,914	356,381
Virginia	21,430	255,561	12,404	142,313	33,295	299,132	60,040	520,209	(1)	(1)	12,437	118,055	(1)	(1)			349,132	3,213,897
Washington			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)			(1)	(1)
West Virginia	18,158	144,577	3,883	87,905	149,465	1,380,121	(1)	(1)	(1)	(1)	6,814	63,336	(1)	(1)	(1)	(1)	350,317	3,535,352
Wisconsin	(1)	(1)	16,610	182,346	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	7,237	186,662			107,339	1,254,751
Undistributed[1]	33,394	352,759	97,372	1,414,046	143,193	1,582,630	246,236	2,672,921	41,771	484,259	298,001	3,005,482	931,626	9,626,625	510,966	6,194,091	626,245	7,226,725
Total	328,528	3,544,320	1,052,097	13,643,743	1,108,174	10,803,247	575,507	5,889,359	75,052	822,110	498,217	5,119,362	1,362,019	13,567,007	1,318,708	15,930,226	6,318,302	69,319,374

[1] Figures that may not be shown separately are combined as "Undistributed."

Lime (quick and hydrated) sold by producers in the United States, 1948–49, by uses

Use	1948			1949		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Agricultural	323,300	$3,296,071	$10.20	328,528	$3,544,320	$10.79
Building:						
Finishing lime	564,163	7,330,833	12.99	502,013	6,800,540	13.55
Mason's lime	443,467	5,276,010	11.90	423,033	5,463,439	12.76
Prepared masonry mortars	58,977	556,751	9.44	56,791	588,435	10.36
Unspecified	73,911	840,683	11.37	70,260	791,329	11.26
Total	1,140,518	14,004,277	12.28	1,052,097	13,643,743	12.97
Chemical and industrial:						
Alkalies (ammonium, potassium, and sodium compounds)	(1)	(1)	(1)	1,728	20,928	12.11
Asphalts and other bitumens	381	6,100	16.01	180	2,445	13.58
Bleach, liquid and powder [2]	6,391	67,535	10.57	7,063	81,549	11.55
Brick, sand-lime and slag	25,414	281,208	11.07	19,369	223,247	11.53
Brick, silica (refractory)	13,419	139,938	10.43	12,942	153,594	11.87
Calcium carbide and cyanamide	569,643	4,829,752	8.48	480,141	4,023,613	8.38
Calcium carbonate (precipitated)	20,318	220,433	10.85	22,458	199,161	8.87
Coke and gas (gas purification and plant byproducts)	29,972	276,430	9.22	24,697	254,638	10.31
Explosives	4,501	40,833	9.07	(1)	(1)	(1)
Food products:						
Creameries and dairies	735	12,253	16.67	737	13,486	18.30
Gelatin	8,390	87,585	10.44	5,790	68,154	11.77
Stock feed	26,353	289,325	10.98	26,818	300,976	11.22
Other [3]	3,125	37,269	11.93	1,894	25,009	13.20
Glassworks	235,866	2,064,382	8.75	171,132	1,715,181	10.02
Glue	11,039	102,845	9.32	7,922	83,199	10.50
Grease, lubricating	5,697	56,886	9.99	3,195	32,940	10.31
Insecticides, fungicides, and disinfectants	92,037	1,012,913	11.01	79,608	920,555	11.56
Medicines and drugs	12,350	109,303	8.85	10,407	97,256	9.35
Metallurgy:						
Nonferrous smelter flux	2,901	32,215	11.10	1,391	20,317	14.61
Steel (open-hearth and electric furnace flux)	1,131,098	10,177,450	9.00	878,189	8,490,669	9.67
Ore concentration [4]	208,233	1,918,021	9.21	183,862	1,747,779	9.51
Wire drawing	18,585	212,030	11.41	17,700	216,694	12.24
Other [5]	29,938	325,130	10.86	27,032	327,788	12.13
Paints	13,796	151,552	10.99	17,903	208,519	11.65
Paper mills [2]	697,884	6,715,006	9.62	575,507	5,889,359	10.23
Petroleum refining	51,737	550,698	10.64	46,620	500,256	10.73
Rubber manufacture	1,154	13,976	12.11	715	7,967	11.14
Salt refining	7,234	59,721	8.26	7,492	68,905	9.20
Sewage and trade-wastes treatment	101,917	1,061,200	10.41	91,879	1,007,634	10.97
Soap and fat	5,288	43,186	8.17	3,184	31,964	10.00
Sugar refining	24,510	403,393	16.46	35,456	529,169	14.92
Tanneries	88,329	872,583	9.88	75,052	822,110	10.95
Varnish	277	4,044	14.60	329	5,046	15.34
Water purification	475,287	4,538,675	9.55	498,217	5,119,362	10.28
Wood distillation	(1)	(1)	(1)	4,787	49,250	10.29
Undistributed [6]	93,090	1,023,668	11.00	87,071	951,201	10.92
Unspecified	238,514	2,277,819	9.55	190,502	1,991,165	10.45
Total	4,255,403	40,015,349	9.40	3,618,969	36,201,085	10.00
Refractory lime (dead-burned dolomite)	1,544,755	17,847,182	11.55	1,318,708	15,930,226	12.08
Grand total lime [7]	7,263,976	75,162,879	10.35	6,318,302	69,319,374	10.97
Hydrated lime included in above distribution	1,822,663	20,962,879	11.50	1,693,946	20,854,543	12.31

[1] Included with "Undistributed."
[2] Bleach used in paper mills excluded from "Bleach" and included with "Paper mills."
[3] Includes citrates, tartrates, and miscellaneous food products.
[4] Includes flotation, cyanidation, bauxite purification, and magnesium manufacture.
[5] Includes barium and vanadium processing, cupola, gold recovery, and unspecified metallurgical uses.
[6] Includes alcohol, chromates and bichromates, magnesia (85 percent), polishing compounds, retarder, sugar, tobacco, and miscellaneous industrial uses; in addition acid neutralization, alkalies, and wood distillation in 1948 and explosives in 1949.
[7] Includes lime used by producers (captive tonnage) as follows—1948: 362,368 tons, valued at $2,843,972; 1949: 355,367 tons, $3,171,392.

Hydrated lime sold by producers in the United States, 1948–49, by uses

Use	1948			1949		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Agricultural	220,261	$2,363,200	$10.73	216,715	$2,481,195	$11.45
Building	888,855	10,774,041	12.12	828,564	10,794,161	13.03
Chemical and industrial:						
Bleach, liquid and powder	2,458	23,742	9.66	3,132	36,378	11.61
Brick, sand-lime and slag	9,493	116,249	12.25	4,907	62,354	12.71
Brick, silica	11,813	125,134	10.59	11,412	138,476	12.13
Coke and gas	1,182	12,220	10.34	1,135	12,896	11.36
Food products	13,193	147,356	11.17	12,993	157,914	12.15
Insecticides, fungicides, and disinfectants	76,258	859,210	11.27	64,825	763,231	11.77
Metallurgy	65,565	744,177	11.35	36,670	491,645	13.41
Paints	9,712	111,370	11.47	12,340	149,967	12.15
Paper mills	46,807	480,802	10.27	44,424	499,630	11.25
Petroleum	28,131	347,141	12.34	26,558	310,894	11.71
Sewage and trade-wastes treatment	57,161	632,303	11.06	48,285	559,870	11.60
Sugar refining	16,957	315,022	18.58	26,347	427,864	16.24
Tanneries	45,022	470,485	10.45	42,604	492,578	11.56
Water purification	211,483	2,185,618	10.33	230,819	2,532,456	10.97
Undistributed [1]	25,026	258,335	10.32	24,162	267,475	11.07
Unspecified	93,286	996,474	10.68	58,054	675,559	11.64
Total	713,547	7,825,638	10.97	648,667	7,579,187	11.68
Grand total hydrated lime	1,822,663	20,962,879	11.50	1,693,946	20,854,543	12.31

[1] Includes glass, glue, grease (lubricating), magnesia (85 percent), medicines and drugs, rubber, and miscellaneous industrial uses.

To furnish a more comprehensive picture of the various materials used for liming land the accompanying table shows, in addition to agricultural lime, the quantities of oystershell, limestone, and calcareous marl that are applied to soil amendment.

Agricultural lime and other liming materials sold by producers in the United States, 1948–49, by kinds

Kind	1948				1949			
	Short tons		Value		Short tons		Value	
	Gross weight	Effective lime content [1]	Total	Average	Gross weight	Effective lime content [1]	Total	Average
Lime:								
Quicklime	103,039	87,580	$932,871	$9.05	111,813	95,040	$1,063,125	$9.51
Hydrated lime	220,261	154,180	2,363,200	10.73	216,715	151,700	2,481,195	11.45
Oystershells (crushed) [2]	48,505	22,800	333,787	6.88	38,366	18,030	268,458	7.00
Limestone	20,941,530	9,842,520	32,034,698	1.53	21,482,910	10,096,970	33,251,141	1.55
Calcareous marl	114,759	48,200	145,712	1.27	166,800	70,060	231,975	1.39
Total		10,155,280	35,810,268			10,431,800	37,295,894	

[1] Calculated upon basis of average percentages used by the National Lime Association, as follows: Quicklime (including lime from oystershells), 85 percent; hydrated lime, 70 percent; pulverized uncalcined limestone and oystershells, 47 percent; calcareous marl, 42 percent.

[2] Figures compiled by Fish and Wildlife Service.

Apparent Consumption.—Lime plants are widely distributed, and most of the lime manufactured is used in local market areas. However, as some States produce a surplus and others are deficient in production, considerable quantities enter interstate trade. Furthermore, limes vary considerably in physical and chemical properties, and the peculiar needs of various industries commonly demand shipments from distant points. The principal States that "export" lime beyond their borders are Ohio, Missouri, Pennsylvania, and West Virginia. Sales, shipments, and supplies of lime available for consumption in continental United States, by States, and groups of States are listed in the accompanying tables.

Apparent consumption of open-market lime in continental United States in 1949, by States, in short tons

State	Sales by producers	Shipments from State [1]	Shipments into State	Apparent consumption		
				Quicklime	Hydrated lime	Total
Alabama	359,446	110,881	33,723	267,776	14,512	282,288
Arizona	43,529	12,862	7,404	32,711	5,360	38,071
Arkansas	(2)	(2)	(2)	23,687	6,067	29,754
California	153,483	20,647	53,519	140,982	45,373	186,355
Colorado	(2)	(2)	(2)	16,241	6,717	22,958
Connecticut	(2)	(2)	(2)	21,476	23,023	44,499
Delaware			40,221	25,433	14,788	40,221
District of Columbia			14,275	144	14,131	14,275
Florida	(2)		(2)	55,362	45,065	100,427
Georgia	7,028	1,030	72,368	49,697	28,669	78,366
Idaho			4,502	2,983	1,519	4,502
Illinois	276,161	124,791	303,667	342,252	112,785	455,037
Indiana	(2)	(2)	(2)	136,360	41,676	178,036
Iowa			84,279	62,796	21,483	84,279
Kansas			37,776	18,546	19,230	37,776
Kentucky			216,918	196,081	20,837	216,918
Louisiana			112,655	84,454	28,201	112,655
Maine	(2)	(2)	(2)	63,875	5,561	69,436
Maryland	64,299	13,282	106,794	110,785	47,046	157,831
Massachusetts	107,931	65,433	42,070	39,834	44,734	84,568
Michigan	(2)	(2)	(2)	216,002	75,207	291,209
Minnesota	(2)	(2)	(2)	59,890	15,534	75,424
Mississippi			20,108	14,440	5,668	20,108
Missouri	878,561	748,004	25,841	111,436	44,962	156,398
Montana	(2)	(2)	(2)	15,846	3,299	19,145
Nebraska			8,982	2,092	6,890	8,982
Nevada	(2)	(2)	(2)	22,547	1,825	24,372
New Hampshire			12,068	3,976	8,092	12,068
New Jersey	(2)	(2)	(2)	64,450	113,575	178,025
New Mexico			6,963	952	6,011	6,963
New York	(2)	(2)	(2)	221,584	155,402	376,986
North Carolina			51,245	15,188	36,057	51,245
North Dakota			7,143	2,804	4,339	7,143
Ohio	1,712,248	1,171,611	291,038	682,685	148,990	831,675
Oklahoma	(2)	(2)	(2)	18,707	23,196	41,903
Oregon			30,559	26,648	3,911	30,559
Pennsylvania	911,065	398,815	479,114	767,768	223,596	991,364
Rhode Island			9,793	3,406	6,387	9,793
South Carolina			17,842	7,979	9,863	17,842
South Dakota	(2)		(2)	2,297	3,035	5,332
Tennessee	117,053	94,962	22,396	14,505	29,982	44,487
Texas	173,724	23,828	27,758	123,900	53,754	177,654
Utah	36,082	694	15,336	45,866	4,858	50,724
Vermont	28,914	27,685	862	450	1,641	2,091
Virginia	349,132	241,786	63,164	125,627	44,883	170,510
Washington	(2)	(2)	(2)	22,096	8,543	30,639
West Virginia	350,311	323,504	195,934	201,651	21,090	222,741
Wisconsin	107,339	50,690	73,117	88,233	41,533	129,766
Wyoming			1,776	442	1,334	1,776
Undistributed [2]	626,245	279,913	1,141,813			
Total	6,302,551	3,710,398	3,633,023	4,574,942	1,650,234	6,225,176

[1] Includes 77,375 tons exported or unclassified as to destination.
[2] Figures that may not be shown separately are combined as "Undistributed."

Apparent consumption of open-market lime in continental United States in 1949, by region of origin and destination, in short tons

Destination	Origin														
	Illinois, Indiana, Michigan, Ohio			Maryland, New Jersey, New York, Pennsylvania, West Virginia			Connecticut, Maine, Massachusetts, Vermont			Florida, Georgia, Virginia			Alabama, Tennessee		
	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total
Illinois, Indiana, Michigan, Ohio	924, 820	308, 741	1, 233, 561	91, 687	5, 763	97, 450	175	--------	175	37, 064	4, 516	41, 580	--------	2, 325	2, 325
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	350, 058	181, 210	531, 268	857, 965	364, 095	1, 222, 060	35, 964	21, 540	57, 504	123, 177	13, 466	136, 643	6, 692	810	7, 502
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	979	26, 804	27, 783	53, 791	6, 283	60, 074	76, 909	53, 941	130, 850	1, 135	190	1, 325	--------	2, 220	2, 220
Florida, Georgia, North Carolina, South Carolina, Virginia	6, 494	70, 685	77, 179	16, 611	8, 854	25, 465	--------	--------	--------	139, 671	49, 781	189, 452	89, 404	34, 215	123, 619
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	65, 362	33, 363	98, 725	708	691	1, 399	--------	--------	--------	5, 091	2, 438	7, 529	298, 001	35, 581	333, 582
Arkansas, Kansas, Nebraska, Oklahoma, Texas	6, 936	10, 507	17, 443	21	--------	21	--------	--------	--------	--------	--------	--------	1, 188	750	1, 938
Iowa, Minnesota, Missouri, Wisconsin	44, 816	51, 014	95, 830	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	11, 417	7, 032	18, 449	54	1	55	--------	15	15	--------	--------	--------	--------	188	188

Apparent consumption of open-market lime in continental United States in 1949, by region of origin and destination, in short tons—Continued

Destination	Origin: Arkansas, Oklahoma, Texas			Minnesota, Missouri, Wisconsin			Arizona, California, Colorado, Montana, Nevada, South Dakota, Utah, Washington			Total		
	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total
Illinois, Indiana, Michigan, Ohio		281	281	323,553	57,032	380,585				1,377,299	378,658	1,755,957
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	928		928	17,031	8,507	25,538				1,391,815	589,628	1,981,443
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont				203		203				133,017	89,438	222,455
Florida, Georgia, North Carolina, South Carolina, Virginia	75	70	145	1,598	932	2,530				253,853	164,537	418,390
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	36,489	13,946	50,435	171,605	13,181	184,786				577,256	99,200	676,456
Arkansas, Kansas, Nebraska, Oklahoma, Texas	148,061	75,234	223,295	30,726	22,466	53,192		180	180	186,932	109,137	296,069
Iowa, Minnesota, Missouri, Wisconsin	7,337	275	7,612	270,202	72,223	342,425				322,355	123,512	445,867
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	2,626	4,500	7,126	22,019	14,515	36,534	296,299	69,873	366,172	332,415	96,124	428,539

Apparent consumption of open-market hydrated lime from plants in Ohio and total continental United States in 1949, by region of destination

Destination	From Ohio plants			From all plants in continental United States	
	Short tons	Distribution (percent)	Percent of total shipments	Short tons	Distribution (percent)
Illinois, Indiana, Michigan, Ohio	278,768	44	74	378,658	23
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	181,153	29	31	589,628	35
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	26,804	4	30	89,438	5
Florida, Georgia, North Carolina, South Carolina, Virginia	70,661	11	43	164,537	10
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	28,372	5	29	99,200	6
Arkansas, Kansas, Nebraska, Oklahoma, Texas	9,607	1	9	109,137	6
Iowa, Minnesota, Missouri, Wisconsin	31,066	5	25	123,512	7
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	6,318	1	7	96,124	6
Undistributed and exports	2,796	(1)	9	29,532	2
Total	635,545	100	38	1,679,766	100

1 Less than 1 percent.

The small quantities of lime shipped from the United States to various island Territories are shown in the accompanying table.

Lime shipped to noncontiguous Territories of the United States, 1946–49

[U. S. Department of Commerce]

Territory	1946		1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Guam					1	$64		
Hawaii	406	$8,373	833	$17,330	(1)	(1)	(1)	(1)
Puerto Rico	365	5,276	2,698	27,844	1,912	30,508	5,964	$112,334
Virgin Islands	142	3,160	57	1,603	100	2,313	256	7,268

1 Data not available.

PRICES

The uptrend in prices noted in 1948 continued in 1949. In the latter year the average selling price, f. o. b. plant, was $10.97 per short ton compared with $10.35 in 1948. The average selling price of quicklime in 1949 was $10.48 ($9.96 in 1948) and of hydrated lime $12.31 ($11.50 in 1948).

FOREIGN TRADE[2]

Imports.—Imports of lime into the United States are relatively small. Most of it enters from Canada to satisfy local needs in border areas, particularly in the State of Washington. Imports during recent years are indicated in the following tables.

Exports.—Exports of lime increased steadily during recent years but are still relatively small. Canada and Latin America are the principal foreign markets.

2 Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Lime imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Hydrated lime		Other lime		Dead-burned dolomite [1]		Total	
	Short tons [2]	Value	Short tons [2]	Value	Short tons [2]	Value	Short tons [2]	Value
1945	677	$6,501	20,142	$172,676	(3)	$7	20,819	$179,184
1946	611	8,538	24,664	248,311	----	----	25,275	256,849
1947	1,903	24,588	25,454	271,253	53	2,194	27,410	298,035
1948	2,861	48,157	30,336	401,473	2,427	91,613	35,624	541,243
1949	1,674	35,129	30,807	545,792	1,851	72,680	34,332	653,601

[1] "Dead-burned basic refractory material consisting chiefly of magnesia and lime."
[2] Includes weight of immediate container.
[3] Less than 1 ton.

Lime imported for consumption in the United States, 1947–49, by countries and customs districts [1]

[U. S. Department of Commerce]

Country of origin	Customs district of entry	1947		1948		1949	
		Short tons [2]	Value	Short tons [2]	Value	Short tons [2]	Value
Canada	Alaska	(3)	$12	(3)	$1	----	----
	Buffalo	3,440	27,397	6,680	63,263	2,824	$27,145
	Duluth and Superior	----	----	51	558	(3)	2
	Maine and New Hampshire	318	2,297	166	1,087	116	741
	Michigan	----	----	252	3,919	----	----
	Montana and Idaho	118	1,157	80	760	----	----
	St. Lawrence	(3)	2	----	----	----	----
	Vermont	----	----	1,405	15,850	----	----
	Washington	23,474	264,614	24,563	364,192	29,541	553,033
United Kingdom	Philadelphia	7	362	----	----	----	----
Total		27,357	295,841	33,197	449,630	32,481	580,921

[1] Exclusive of dead-burned basic refractory material.
[2] Includes weight of immediate container.
[3] Less than 1 ton.

Lime exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1945	24,276	$268,875	1948	63,088	$865,157
1946	33,540	423,948	1949	59,927	937,444
1947	50,784	713,703			

TECHNOLOGY

A kiln embodying the new "fluosolids" method of calcining limestone has been placed in operation at the plant of the New England Lime Co. at Adams, Mass. The new kiln will produce about half of the lime made at this plant. An encouraging decrease in production costs has been noted.

A new type of limekiln adapted to calcining small-size stone has been introduced in a lime plant at Seattle, Yorkshire, England. It is the second kiln of this type to be used. The first one is employed for calcining chalk into lime at Croydon, Surrey. The successful use of such a kiln where limestone is the raw material would be advantageous because, in many instances, the small sizes that inevitably accumulate

Lime exported from the United States, 1947–49, by countries

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Argentina	89	$3,162	28	$983	2	$154
Bahamas	63	3,069	65	1,850	58	1,115
Belgium-Luxembourg	95	6,156	59	3,840	75	3,872
Brazil	36	665	7	597	1	106
British Honduras	----------	----------	----------	----------	101	1,551
British Western Pacific Islands	----------	----------	----------	----------	140	3,795
Canada	16,435	173,257	29,127	291,639	17,304	199,855
Canal Zone	59	1,390	738	13,675	87	2,491
Chile	529	8,435	100	2,096	5,021	83,387
Colombia	806	13,500	1,563	27,877	2,369	46,501
Costa Rica	7,486	90,281	7,736	108,338	8,244	144,785
Cuba	82	1,227	1,153	18,529	40	709
Dominican Republic	208	3,303	461	8,140	611	10,970
El Salvador	218	5,951	54	1,618	55	1,829
Haiti	307	4,640	622	9,661	275	5,119
Honduras	8,722	109,629	10,200	140,602	9,393	148,318
Liberia	46	1,499	39	902	----------	----------
Mexico	5,070	70,558	3,073	52,458	7,254	91,160
Netherlands Antilles	145	3,097	225	4,680	156	3,148
New Zealand	----------	----------	----------	----------	100	2,016
Nicaragua	465	9,338	35	1,740	345	6,866
Panama	6,623	78,785	4,282	58,936	6,123	109,199
Peru	76	1,569	61	1,805	----------	----------
Philippines	1,030	22,561	320	6,578	507	20,351
Saudi Arabia	96	2,023	264	7,159	19	1,228
Sweden	169	11,543	171	11,484	----------	----------
United Kingdom	1,098	56,903	913	55,640	456	23,940
Venezuela	253	3,088	1,508	26,420	980	19,206
Other countries	578	28,074	284	7,910	211	5,773
Total	50,784	713,703	63,088	865,157	59,927	937,444

are wasted owing to the difficulty of calcining them in standard kilns. No data are now available on the design of the new kilns.

The Kelley Island Lime & Transport Co. has placed in operation at White Rock, Ohio, four forced-draft, center-burner gas kilns designed by Azbe Engineers, Inc. They are equipped with the most modern control instruments. High efficiency is reportedly attained. Each kiln produces 50 tons of lime a day and the fuel : lime ratio approaches 1 : 5.[3]

G. & W. H. Corson, Inc., Plymouth Meeting, Pa., has been perfecting for some years a process of pressure hydration of dolomitic (high-magnesium) lime. A product of superior quality has been produced. The method of manufacture has gradually evolved from batch to continuous process. The latest improvements are incorporated in a continuous hydrator built in 1948. An "explosion" method is employed to eliminate surplus water from the hydrate.

The National Lime Association is sponsoring at the Massachusetts Institute of Technology fundamental research devoted primarily to correlation of lime-burning conditions with the properties of lime. The rate of slaking, for instance, is influenced greatly by the time and temperature of calcination. Pure, optical-grade, cleavable calcite is used as a reference material. Effects of impurities will be a later project objective.[4]

[3] Nordburg, Bror, Center Burner Vertical Lime Kilns: Rock Products, vol. 52, No. 11, November 1949, pp. 66–69.

[4] Avery, William M., Kelley Island Builds New Gas-Fired Shaft Kiln Plant at White Rock, Ohio: Pit and Quarry, vol. 41, No. 11, May 1949, pp. 94–96.

Magnesium

By Richard H. Mote and Horace F. Kurtz

GENERAL SUMMARY

AN INCREASE in production and consumption of magnesium, as contrasted to most other metals, was recorded in 1949. Its unique economic position was emphasized by a stable market price, which remained unchanged throughout the year at 20.5 cents a pound for domestic virgin ingot, commercially pure. The total output of 11,598 short tons produced during 1949 came from the Dow Chemical Co. reduction plant at Freeport, Tex. The privately owned capacity of this plant was increased in 1949 through acquisition of the Government-held portion of the facility. Wider acceptance of magnesium for structural products was indicated by the 1949 data on consumption, although much of the metal was used for military purposes. Apparent consumption of primary magnesium totaled 12,545 tons compared with 8,215 tons in 1948. In addition to primary supplies, about 6,000 tons of magnesium were recovered from secondary sources. Year-end stocks of primary metal at the only producing plant and at consumers' plants were approximately equal to 1 year's production at the average rate of output in 1948–49.

Salient statistics of the magnesium metal industry in the United States, 1940–44 (average) and 1945–49

	1940–44 (average)	1945	1946	1947	1948	1949
Production of primary magnesium [1] ... short tons	82,441	32,792	5,317	12,344	10,003	11,598
Quoted price per pound ... cents	22.6	20.5	20.5	20.5	20.5	20.5
Consumption, apparent ... short tons	72,947	43,000	8,709	4,949	8,215	12,545
Exports [2] ... do	12,617	518	207	315	274	432
World production ... do	143,300	54,900	12,900	[3] 21,400	[3] 21,300	23,700

[1] Ingot equivalent.
[2] Magnesium metal and alloys, 1940 and 1943–45; metal, 1941–42, and 1946–49.
[3] Revised figure.

United States conducted little foreign trade in magnesium during 1949, although imports of metal, including scrap, increased to 2,560 tons. World production of magnesium was estimated to have gained 11 percent, totaling 21,500 short tons. United States produced nearly half of the total, and United Kingdom, U. S. S. R., and France, most of the remainder.

PRODUCTION

Primary.—Since July 1946 the Freeport, Tex., plant of the Dow Chemical Co. has been the only domestic producer of primary magnesium. Output remained nearly constant throughout 1949 and totaled 11,598 short tons, or 16 percent above the 1948 figure. Although production has been only a small fraction of the record achieved during World War II, it has been maintained considerably above prewar levels and has gradually increased since the summer of 1948.

Increased demand for magnesium encouraged the Dow Chemical Co. to expedite the anticipated purchase of the Government facilities at Freeport, Tex., in 1949. Dow thereby increased the rated annual capacity of its plant to 18,000 short tons, although production rates in excess of this capacity had previously been attained. Sale of the Government-owned portion of the plant was announced by the Federal Works Agency in May 1949. In addition to this privately owned plant, the Government had seven plants remaining from World War II which have been placed in stand-by condition for emergency use. Two of these plants are electrolytic reduction plants located at Valasco, Tex., and Painesville, Ohio, and five are ferrosilicon reduction plants at Luckey, Ohio; Canaan, Conn.; Manteca, Calif.; Wingdale, N. Y.; and Spokane, Wash.

Production of primary magnesium in the United States, 1948–49, by months, in short tons [1]

Month	1948	1949	Month	1948	1949
January	883	988	August	809	970
February	830	884	September	819	974
March	887	988	October	873	941
April	801	958	November	814	969
May	797	987	December	932	1,004
June	766	950			
July	792	985	Total	10,003	11,598

[1] Monthly figures have been adjusted to final annual totals.

Although magnesium was considered an important war material by Government military authorities, the supply of raw materials for producing the metal has never been critical. The only commercial producer in 1949 used sea water as its source. It has been estimated that a cubic mile of ocean water contains 6,000,000 tons of magnesium—far more than the world output since the metal was first produced. Dolomite, magnesite, underground brines, and various other magnesium-bearing materials also provide virtually inexhaustible supplies of ore suitable for other production methods.[1]

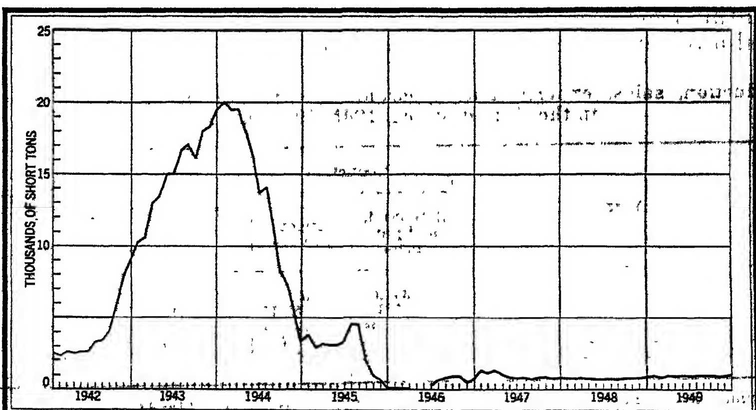

FIGURE 1.—Trends in domestic production of primary magnesium, 1942–49.

[1] Gross, W. H., The Story of Magnesium: Am. Soc. for Metals, Cleveland, Ohio, 1949, 258 pp.

Magnesium fabricating facilities were more active during 1949 as a result of increased demand for sheet, extrusions, and castings. Expansion of rolling-mill capacity was indicated by plans revealed in 1949.

Secondary.—Recovery of secondary magnesium, including alloying ingredients and secondary magnesium incorporated in primary ingot, totaled 5,962 short tons in 1949 compared with 7,553 tons (revised) in 1948. Of this quantity, 5,860 tons were recovered from 6,458 tons of magnesium-base scrap in 1949. Old scrap constituted about 48 percent of the scrap consumed compared with 52 percent (revised) in 1948. Of the 1949 recovery, 4,249 tons were in ingot form, 681 tons in castings, 96 tons in magnesium-alloy shapes, 294 tons in aluminum-base alloys, 4 tons in zinc-base alloys, 555 tons in anodes and strip for cathodic protection, and 83 tons in chemicals and other nonrecoverable forms. Additional information on secondary magnesium may be found in the Secondary Metals—Nonferrous chapter of this volume.

CONSUMPTION AND USES

Emerging from a postwar recession in the use of magnesium, which was at its lowest in 1947 and early 1948, shipments of primary metal from the only producing plant increased 53 percent to 12,545 short tons in 1949. Demand for defense purposes brought sales to a high level during 1949 despite a decline in most other industries. Use of metal for military aircraft, which during World War II caused the first great advances in the application of magnesium, was responsible for renewed gains in consumption. Increasing realization of the advantages in the weight factor of magnesium over aluminum castings for aircraft resulted in gains in this field, and demand for sheet and extrusions was also strong. Magnesium was utilized too in the production of movable civilian products such as tools, handling equipment, machinery and vehicle parts, and other products where light weight resulted in savings in operation costs.

Consumers reported greater use of primary magnesium during 1949, resulting from a nearly 50-percent increase in its application for structural products. Largest advances were noted in consumption for sand

Production, sales, exports, and apparent consumption of primary magnesium in the United States, 1945–49, in short tons

Year	Production		Sales	Exports [1]	Apparent consumption [2]
	Raw, crude, and pure ingot	Ingot equivalent			
1945	33,106	32,792	3,496	496	43,000
1946	5,317	5,317	8,916	207	8,709
1947	12,344	12,344	5,264	315	4,949
1948	10,003	10,003	8,489	274	8,215
1949	11,598	11,598	12,977	432	12,545

[1] Primary metal only. Alloy exports in addition: 22 tons in 1945; none in 1946–49.
[2] Does not consider fluctuations in consumers' stocks and metal derived from scrap. Withdrawals from producers' stocks totaled 18,704 tons in 1945, 3,500 in 1946, and 1,379 in 1949. Additions to producers' stocks totaled 7,060 tons in 1947 and 1,514 tons in 1948.

castings, sheet, and extrusions. Extrusions continued to lead the field of uses, but sand castings replaced aluminum-base alloys as the second largest classification. Less primary magnesium was used in nonstructural products than in 1948.

The Bureau of Census, United States Department of Commerce, reported that shipments of magnesium castings and wrought products increased 14 and 41 percent, respectively, in 1949.

Use of magnesium in cathodic protection of steel pipelines, water heaters, and surfaces exposed to sea water continued to increase. Because of its position in the electrochemical series, magnesium can act as an anode in electrolytic action and greatly reduce corrosion of other metals. For this expendable use magnesium frequently is derived from scrap metal. During 1949 magnesium also was used in increasing quantities for photoengravings and blocking bases in the printing industry. Comparing favorably with other photoengraving metals, particularly zinc, magnesium afforded fine-grained etchings at high speeds, with less acid in the baths. The magnesium plates were long-wearing while light in weight for easy handling.

Transportation remained the largest field of magnesium consumption during 1949. Over 5 tons of magnesium sheet was used in the production of each B–36 airplane, over 1 ton in the airframe of the Navy's Chance-Vought F7U, and approximately 1 ton of extrusions in the floor beams of the Douglas C–124 Globemaster. Substantial quantities of magnesium were used in commercial highway vehicles, especially for extruded truck flooring.

Actual domestic consumption of primary magnesium (ingot equivalent and magnesium content of magnesium-base alloys) by uses, 1945–49, in short tons

Product	1945 [1]	1946	1947	1948	1949
Structural products:					
Castings:					
Sand	18,405	920	892	1,930	3,088
Die	803	341	182	213	127
Permanent mold	8,307	38	9	12	44
Sheet	1,517	1,990	1,053	[2] 1,261	2,155
Structural shapes, rods, tubing (extrusions)	2,452	2,689	1,619	2,529	3,364
Forgings	157	99	105	103	200
Total structural	31,641	6,077	3,860	[2] 6,048	8,978
Other products:					
Powder	4,769	192	9	(3)	-----
Aluminum alloys	5,589	2,391	1,935	[2] 2,171	1,759
Other alloys	24	41	40	43	39
Scavenger and deoxidizer	228	248	427	418	404
Chemical	182	150	266	407	224
Cathodic protection	1,554	774	94	[2] 385	235
Other [4]			288	[2] 226	308
Total other products	12,346	3,796	3,009	[2] 3,650	2,969
Grand total	43,987	9,873	6,869	[2] 9,698	11,947

[1] Figures are incomplete owing to lack of returns from a number of wartime companies whose operations terminated during the year.
[2] Revised figure.
[3] Less than 1 ton.
[4] Includes primary metal consumed in making secondary alloy.

Numerous new tools for construction work were designed in 1949 to utilize magnesium's light weight and high strength. Demand for faster and more efficient textile equipment [2] encouraged the use of magnesium for manufacturing machinery.

Other new uses for magnesium included wall forms for pouring concrete and new die castings for automobiles. Consumption of magnesium in the production of titanium metal appeared to be another potentially large use developed since World War II. Research was in progress during 1949 to determine the possibility of using magnesium powder as a jet-engine fuel.

STOCKS

Inventories of primary magnesium ingot at the Freeport, Tex., plant declined to approximately two-thirds of annual production by December 31, 1949. Total consumers' stocks of primary metal comprised about 2,500 tons, virtually the same as at the end of 1948.

Government agencies continued to hold the large quantities of magnesium mentioned in the 1948 edition of this series. Of the approximately 25,000 tons of low-zinc magnesium alloy bomb bodies reported in plants throughout the United States, an undisclosed portion was demilitarized and transferred to the Bureau of Federal Supply. Magnesium was not on the list of materials to be purchased for the National Stockpile in 1949. Storage of magnesium ingots in a manner that would prevent deterioration continued to be a stockpiling problem.

PRICES

For the seventh consecutive year the base price of standard virgin magnesium ingot remained at 20.5 cents per pound, the price established in January 1943. The stability of primary magnesium prices and the reductions made in certain manufacturing processes have been one of the major selling points for the metal during the postwar period.

FOREIGN TRADE [3]

Imports.—During 1949 imports of magnesium in all forms increased 278 percent to a record level of 2,560 short tons. Virtually all the receipts were classified as metallic and scrap; the total consisted of 962 tons from United Kingdom, 564 tons from Germany, 421 tons from Austria, 212 tons from Czechoslovakia, 194 tons from Switzerland, 99 tons from Italy, 38 tons from Egypt, 30 tons from France, 28 tons from Belgium, 7 tons from Sweden, and 5 tons from Canada. Effective tariff rates on magnesium in 1949 were as follows: Metallic, 20 cents per pound; metallic scrap, 20 cents per pound (duty suspended until June 30, 1949, but suspension discontinued thereafter); and alloys, powder, sheets, tubing, wire, manufactures, etc., 20 cents per pound on magnesium content plus 10 percent ad valorem.

Exports.—Magnesium exports totaled 59 percent above the 444 tons shipped in 1948. Of the metal exported in primary form during 1949, 360 tons went to Mexico, 27 tons to Argentina, 20 tons to Colombia, and the remaining 25 tons to 9 other countries. Venezuela

[2] Nuernberger, H., Magnesium Uses Grow in Textile Equipment Field: Modern Metals, vol. 5, No. 6, July 1949, pp. 14–16.

[3] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

received 65 tons of the powder, ribbons, and metal in other forms exported; Saudi Arabia, 49 tons; Mexico, 41 tons; Canada, 37 tons; Kuwait, 34 tons; Colombia, 25 tons; Iran, 15 tons; and a total of 10 tons to 13 other countries.

Magnesium imported for consumption and exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Imports								Exports			
	Metallic and scrap		Alloys (magnesium content)		Powder (magnesium content)		Sheets, tubing, ribbons, wire, and other, n. s. p. f. (magnesium content)		Metal in primary form		Powder, ribbons, and metal in other forms	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	54	$14,422	(1)	$94	3	$2,814	------	------	518	$216,793	860	$872,166
1946	241	110,983	(1)	3	------	------	(1)	$621	207	85,382	99	54,996
1947	201	87,499	------	------	------	------	1	11,902	315	140,214	40	80,210
1948	678	184,066	(1)	57	------	------	(1)	943	274	122,374	170	149,891
1949	2,560	537,113	(1)	80	------	------	(1)	28	432	184,707	276	214,732

[1] Less than 1 ton.

TECHNOLOGY

Magnesium has long been known to have the unique qualities of light weight coupled with high strength, good workability at comparatively low temperatures, and excellent machinability. Only in the last decade, however, have many of the best alloys been developed. During this period industry has become more familiar with the characteristics of this metal. The fear of igniting magnesium, prevalent before World War II, has been greatly reduced by improved handling techniques.

Like most other metals, pure magnesium is rarely used for structural purposes. Aluminum, zinc, manganese, zirconium, and rare earths have been among the most common alloying ingredients. The recent development of jet engines has increased the need for magnesium alloys capable of high-temperature operation. Two new alloys, a magnesium-cerium-zirconium casting alloy for elevated temperature applications and a magnesium-zinc-zirconium alloy for high-strength extrusions, were introduced in 1949. A comprehensive survey[4] of magnesium alloys revealed that the zinc-silver-manganese-calcium system had good potentialities for magnesium-base alloys. Additional experience in using small quantities of magnesium to increase ductility and strength of cast iron was gained during 1949.

In keeping with the growing knowledge of production technology, much information on designing, casting,[5] extruding, rolling, joining, and surface-treating magnesium has been published since World War II. In 1949, electroplating magnesium to provide finishes for a variety of uses became a commercial practice.

[4] Jones, A., Mayland, R. D., and Nash, R. R., New Magnesium Alloys: Air Force Tech. Rept. 5734, November 1948, 243 pp. (Published by U. S. Department of Commerce, PB 97657.)

[5] Bauer, Alfred F., Magnesium Die Casting in Germany: Modern Metals, vol. 6, Nos. 1, 2, and 3, February, March, and April 1950, pp. 17–22, 27–33, 31–35.

WORLD REVIEW

World production of primary magnesium in 1949 was estimated at 21,500 metric tons or about 11 percent above the 1948 total. Most of the increase was attributed to larger outputs in the United States and United Kingdom. No appreciable gain in civilian demand was noted during the year, and, to a large extent, world markets continued to rely upon military consumption.

World production of magnesium metal, by countries, 1942–49, in metric tons

[Compiled by Pauline Roberts]

Country	1942	1943	1944	1945	1946	1947	1948	1949
Australia	484	497	54	------	------	------	------	------
Canada	367	3,245	4,799	3,338	145	136	(1)	(1)
China:								
Formosa	261	376	432	21	------	------	------	(1)
Manchuria	8	251	450	200	------	------	------	(1)
France	1,334	1,542	703	279	704	1,043	1,507	[2] 700
Germany:	30,000	32,400	33,600	[3] 4,225				
Federal Republic					------	------	[4] 17	------
Soviet Zone					(1)	(1)	(1)	(1)
Italy	2,379	2,017	1,380	346	1,005	------	------	(1)
Japan	2,020	2,777	2,904	1,104	------	------	------	------
Korea	240	532	1,628	1,014	------	------	------	(1)
Norway (estimate)	2,000	2,000	2,000	------	------	------	------	------
Switzerland (estimate)	1,500	1,500	1,000	500	300	500	------	------
U. S. S. R. (estimate)	5,000	5,000	5,000	2,170	3,000	4,000	5,000	5,000
United Kingdom	14,865	19,096	13,094	[5] 6,900	[5] 1,700	[5] 2,500	[5] 3,500	[5] 5,100
United States	44,418	166,544	142,518	29,748	4,823	11,198	9,075	10,521
Total (estimate)	104,900	237,800	209,600	49,800	11,700	19,400	19,300	21,500

[1] Data not available; estimate by author of chapter included in total.
[2] Estimated figure.
[3] January-February only. Planned production for March, 2,830 tons.
[4] British and American zones only.
[5] Includes secondary metal.

Canada.—There was no magnesium production in 1949 from the ferrosilicon plant of Dominion Magnesium, Ltd., at Haley, Ont. The company has utilized stocks of magnesium accumulated during the war years to supply its markets in lieu of output from the plant, which has not produced magnesium since 1945. During the latter part of 1949 the company was considering resuming magnesium production to replenish its inventories. The Aluminium Co. of Canada temporarily discontinued production of magnesium in 1949.

Germany.—Of the five magnesium reduction plants that operated in Germany during the war, four were I. G. Farben-industrie establishments located in what is now the Soviet Zone. It was reported [6] in November that all magnesium productive capacity in the Soviet Zone had been dismantled except the electrolytic plant at Bitterfeld, which was retained for the production of calcium metal.

The American authorities in Western Germany were reported [7] to have ordered during the latter part of 1949 the dismantling of the idle Wintershall magnesium plant at Heringen.

United Kingdom.—During 1949 magnesium fabricators in the United Kingdom produced 732 long tons of sheet and strip, 56 tons of extrusions, and 2,748 tons of castings other than bombs.

[6] Metal Bulletin (London), No.3442, Nov. 15, 1909, p. 10.
[7] Metal Bulletin (London), No. 3459, Jan. 17, 1950, p. 22.

Magnesium Compounds

By Joseph C. Arundale and F. M. Barsigian

GENERAL SUMMARY

MAGNESITE production in 1949 was the lowest in a decade. Sales of magnesias, particularly refractory magnesias, used principally by the steel industry, were affected by the severe curtailment of steel production to which strikes in the coal industry, a serious strike in the steel industry itself, and the general business recession were contributory factors. Lower consumption, partial liquidation of consumer inventories, and a cautious buyers' market combined to restrict sales of most other magnesias and magnesium compounds.

Salient statistics of magnesite, magnesia, and dead-burned dolomite in the United States, 1945–49

	1945	1946	1947	1948	1949
Crude magnesite:					
Mined:					
Short tons	336,458	324,640	375,993	(1)	287,315
Value [2]	$2,324,957	$2,225,850	$2,596,747	(1)	$1,950,153
Caustic-calcined magnesia:					
Sold or used by producers:					
Short tons	43,270	45,178	26,831	33,209	32,505
Value	$2,503,544	$2,854,538	$2,508,624	$3,380,528	$3,109,381
Average per ton [3]	$57.86	$63.18	$93.50	$101.80	$95.66
Refractory magnesia:					
Sold or used by producers:					
Short tons	254,994	244,824	314,921	330,069	250,389
Value	$7,414,218	$7,231,869	$10,127,585	$13,444,587	$10,477,856
Average per ton [3]	$29.08	$29.54	$32.16	$40.73	$41.85
Dead-burned dolomite:					
Sold by producers:					
Short tons	1,187,334	1,007,983	1,395,203	1,544,755	1,318,708
Value	$10,613,711	$10,101,707	$14,295,359	$17,847,182	$15,930,226

[1] Bureau of Mines not at liberty to publish figure.
[2] Partly estimated; most of crude is processed by mining companies, and very little enters open market.
[3] Average receipts f. o. b. mine shipping point.

DOMESTIC PRODUCTION

Magnesite.—Production of magnesite in 1949 was the lowest since 1939. The tonnage of refractory grades of magnesia sold or used by producers in 1949 dropped sharply, owing principally to curtailment of steel production during the year. Sales of caustic-calcined were less affected but were lower than in the previous year.

Magnesia sold or used by producers in the United States, 1948–49, by kinds and sources

Magnesia	From magnesite, brucite, and dolomite[1]		From well brines, raw sea water, and sea-water bitterns[1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948						
Caustic-calcined	11, 548	$996, 713	21, 661	$2, 383, 815	33, 209	$3, 380, 528
Refractory	214, 628	7, 954, 089	115, 441	5. 490, 498	330, 069	13, 444. 587
Total	226, 176	8, 950, 802	137. 102	7. 874, 313	363, 278	16, 825, 115
1949						
Caustic-calcined	8, 992	$31, 674	23, 513	2, 277, 707	32, 505	3, 109, 381
Refractory	175, 364	6, 763, 294	75, 025	3, 714, 562	250, 389	10, 477, 856
Total	184, 356	7, 594, 968	98, 538	5, 992, 269	282, 894	13, 587, 237

[1] Magnesia made from a combination of dolomite and sea water is included with that from sea water.

Dolomite.—Reduction in the output of steel also was reflected in the decreased sales of dead-burned dolomite, which were the lowest since 1946.

The manufacture of refractory dolomite, including raw material requirements, processing, and costs, was discussed in an article.[1]

Additional information on dolomite may be found in the Stone and Lime chapters of this volume.

Dead-burned dolomite sold in and imported into the United States, 1945–49

Year	Sales of domestic		Imports[1]		Year	Sales of domestic		Imports[1]	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1945	1, 187, 334	$10, 613, 711	(2)	$7	1948	1, 544, 755	$17, 847, 182	2, 427	$91, 613
1946	1, 077, 983	10, 101, 707	------	------	1949	1, 318, 708	15, 930, 226	1, 851	72, 680
1947	1, 395, 203	14, 295, 359	53	2, 194					

[1] Reported as "Dead-burned basic refractory material."
[2] Less than 1 ton.

Other Magnesium Compounds.—Production and sales of both light and heavy high-grade magnesias and magnesium carbonate in 1949 followed the general trend and were lower as a result of the moderate recession in consuming industries.

[1] Gibbs, Ralph, Manufacturing Refractory Dolomite: Rock Products, vol. 2, No. 4, April 1949, pp. 129–131, 161–163.

Specified magnesium compounds produced, sold, and used by producers in the United States, 1948–49

Product [1]	Plants [1]	Produced (short tons)	Sold [2] Short tons	Sold [2] Value	Used (short tons)
1948					
Specified magnesias (basis 100 percent MgO), U. S. P. and technical:					
Extra-light and light	6	1,826	1,837	$909,697	(3)
Heavy	3	1,386	1,289	717,549	
Total	[4] 6		3,126	1,627,246	(3)
Precipitated magnesium carbonate	11	60,898	7,315	939,306	52,798
1949					
Specified magnesias (basis 100 percent MgO), U. S. P. and technical:					
Extra-light and light	5	1,637	1,644	837,751	
Heavy	3	933	949	395,994	(3)
Total	[4] 5		2,593	1,233,745	(3)
Precipitated magnesium carbonate	10	55,925	7,273	924,299	48,641

[1] In addition, in 1948–49, magnesium chloride, hydroxide, nitrate, and sulfate were produced. Bureau of Mines not at liberty to publish figures.
[2] Sales by a producer to an affiliated consumer for immediate use are not included with "Sold" but are with "Used."
[3] Bureau of Mines not at liberty to publish figure.
[4] A plant producing more than 1 grade is counted but once in arriving at total.

REVIEW BY STATES

California.—Johns-Manville Products Corp., 22 East Fortieth Street, New York 16, N. Y., produced magnesium carbonate from purchased magnesium hydroxide at Redwood City, Calif., for use in 85-percent magnesia insulation. Kaiser Aluminum & Chemical Corp. (formerly Permanente Metals Corp.), Kaiser Building, Oakland, Calif., operated its magnesia-from-sea-water plant at Moss Landing, producing refractory and caustic-calcined magnesias. Marine Magnesium Products Corp., South San Francisco, Calif., recovered precipitated magnesium carbonate, magnesium hydroxide, and specialty magnesias, using lime, dolomite, and water from San Francisco Bay as raw materials. The Paraffine Companies, Inc., 1550 Powell Street, Emeryville 8, Calif., produced magnesium carbonate from purchased magnesium hydroxide for use in 85-percent magnesia insulation. This plant was closed for 3½ months owing to a strike. Westvaco Chemical Division, Food Machinery & Chemical Corp., 405 Lexington Avenue, New York 17, N. Y., produced a small quantity of magnesite from its western mine near Livermore, Calif., and reported that its calcining plant was idle during 1949. This firm also produced at its Newark plant refractory and caustic-calcined magnesia from sea-water bitterns and dolomite and caustic-calcined magnesia from magnesite. At its Chula Vista plant it recovered magnesium chloride from sea-water bitterns.

Illinois.—Johns-Manville Corp., 22 East Fortieth Street, New York 16, N. Y., produced precipitated magnesium carbonate by the Pattinson process at its Waukegan, Ill., plant for use in 85-percent magnesia insulation.

Michigan.—The Dow Chemical Co., Midland, Mich., produced magnesium chloride and epsom salts from well brines, dolomite, and lime. Michigan Chemical Corp., St. Louis, Mich., produced magnesium carbonate, hydroxide, and magnesia from well brines, dolomite, and lime. The Morton Salt Co., 120 South LaSalle Street, Chicago 4, Ill., produced precipitated magnesium carbonate from well brines at its Manistee, Mich., plant. Standard Lime & Stone Co., 2000 First National Bank Building, Baltimore 3, Md., at its plant at Manistee, produced refractory-grade magnesia from well brines and lime.

Nevada.—Basic Refractories, Inc., 845 Hanna Building, Cleveland, Ohio, during 1949 announced purchase from the General Services Administration, Real Property Disposal Division (formerly War Assets Administration), of a large magnesite deposit in the Paradise Mountains, Nye County, Nev., together with an adjacent ore dressing and calcining plant.[2] This company, which is also the sole producer of brucite in the United States, continued to produce this material from its quarry at Gabbs, Nev.,[3] and shipped most of it to its plant at Maple Grove, Ohio, where it is processed into a line of refractories.

Sierra Magnesite Co., Box 8–A, Newark, Calif., mined magnesite at Gabbs for caustic-calcined use.

Standard Slag Co., Youngstown, Ohio, mined and shipped crude magnesite from its property in the Gabbs District. This company was reported to be installing facilities for calcining its product.[4]

New Jersey.—The J. T. Baker Chemical Co., Phillipsburg, N. J., produced magnesia and magnesium chloride and nitrate from purchased magnesium carbonate. Johns-Manville Corp., at its Manville plant, produced precipitated magnesium carbonate by the Pattinson process for use in 85-percent magnesia insulation. Northwest Magnesite Co., 1922 Farmers Bank Building, Pittsburgh 22, Pa., recovered refractory-grade magnesia from sea water and dolomite at its Cape May, N. J., plant.

Ohio.—The Diamond Alkali Co., 300 Union Commerce Building, Cleveland, Ohio, produced refractory magnesia from dolomite at Fairport.

Pennsylvania.—Both the Philip Carey Manufacturing Co., Cincinnati 15, Ohio, plant at Plymouth Meeting, Pa., and Keasbey & Mattison Co., Ambler, Pa., produced magnesia and precipitated magnesium carbonate. Ehret Magnesia Manufacturing Co., Valley Forge, Pa., produced precipitated magnesium carbonate. All three firms used the Pattinson process, and the magnesium carbonate was for use in 85-percent magnesia insulation.

Texas.—The Dow Chemical Co., at Freeport, Tex., recovered magnesium chloride from sea water as an intermediate in the production of magnesium metal. It also produced some magnesia. Texas

[2] Rock Products, vol. 52, No. 3, March 1949, p. 70.
[3] Holmes, George H., Jr., Mining Methods at the Brucite Deposit, Basic Refractories, Inc., Gabbs, Nye County, Nev.; Bureau of Mines Info. Circ. 7543, 1949, 10 pp.
[4] Mining World, vol. 11, No. 9, August 1949, p. 73.

Industrial Minerals Corp., P. O. Box 25, Llano, Tex., produced magnesite in the last quarter of 1949.

Washington.—Laucks Chemical Co., 1008 Western Avenue, Seattle 4, Wash., mined epsomite and produced epsom salt at Tonasket. Northwest Magnesite Co., 1922 Farmers Bank Building, Pittsburgh 22, Pa., the largest magnesite producer in the United States, produced refractory magnesite near Chewelah. A fire at this company's Keystone quarry caused a temporary shutdown for repairs in the first part of the year, and on October 24 the company stopped all operations for the duration of the steel strike.[5]

West Virginia.—The Standard Lime & Stone Co. recovered refractory magnesia by leaching calcined dolomite at its Millville, W. Va., plant.

PRICES

According to E&MJ Metal and Mineral Markets, at the end of 1949 the price of dead-burned grain magnesite, per ton, in bulk, f. o. b. Chewelah, Wash., was quoted at $30.50 to $31; in bags, $35 to $35.50. The Westvaco Chemical Division of Food Machinery & Chemical Corp., reported no change in prices of its magnesias, which were quoted (carlots, f. o. b. California) as follows: Bulk and powdered caustic-calcined magnesite, $64 in bulk and $70 powdered in bags. The price of calcined sea-water magnesia remained at $64 per ton in bags, powdered. Kiln-run 90-percent sea-water periclase was quoted at $50.50 per ton.

According to the Oil, Paint and Drug Reporter, magnesium hydroxide, medicinal grade, was quoted at 29 to 30 cents per pound in 1949 as for the past few years; magnesium carbonate, technical grade, bags, carlots, freight equalized, was quoted at 9 cents per pound, and magnesium carbonate, U. S. P. grade, at 10¾ cents per pound. Magnesium carbonate is quoted freight allowed to New Jersey (except to Atlantic, Burlington, Cape May, Cumberland, Gloucester, Ocean, and Salem Counties) and to Philadelphia County, Pa. Freight was equalized with New York City on all other destinations. Magnesium chloride, flake, barrels, carlots, works, was quoted at $40 per ton. Epsom salts, technical, bags, carlots, was reduced to $2.15 per 100 pounds from $2.30 in 1948. Magnesia, calcined, technical, cartons, works, was quoted at 32 cents per pound at the end of the year; synthetic, rubber grade, cartons, works, was quoted at 29 to 31 cents per pound; U. S. P. light, cartons, at 34 cents per pound; heavy, barrels, at 36 cents per pound.

FOREIGN TRADE[6]

No imports of crude magnesite were reported during 1949, and imports of magnesias and other magnesium compounds were small. Rapid development of the domestic industry has given the United States a high degree of self-sufficiency in these materials.

[5] Engineering and Mining Journal, vol. 150, No. 12, December 1949, p. 125.
[6] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Magnesite imported for consumption in the United States, 1947–49, by countries

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
CRUDE MAGNESITE						
Canada			37	$4,372		
India			59	1,037		
Total			96	5,409		
LUMP CAUSTIC-CALCINED MAGNESITE						
Canada	(1)	$10	17	$1,858		
Greece	1	52	11	596		
India	498	19,479	713	24,824	568	$19,616
Netherlands	15	1,198			240	14,909
Total	514	20,739	741	27,278	808	34,525
GROUND CAUSTIC-CALCINED MAGNESITE						
Canada			17	$1,862	1	$63
India			102	3,719	662	23,898
Netherlands	2	$175	55	4,250	5	324
United Kingdom	10	1,542	7	1,375	8	1,108
Total	12	1,717	181	11,206	676	25,393
DEAD-BURNED AND GRAIN MAGNESITE AND PERICLASE						
Austria			(1)	$50		
British Guiana			58	5,680		
Canada	1,745	$170,216	2,984	292,107	1,369	$133,518
Czechoslovakia					1,102	48,000
United Kingdom	2	216				
Total	1,747	170,432	3,042	297,837	2,471	181,518

[1] Less than 1 ton.

Magnesium compounds imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Oxide or calcined magnesia		Magnesium carbonate, precipitated		Magnesium chloride (anhydrous and n. s. p. f.)		Magnesium sulfate (epsom salts)		Magnesium salts and compounds, n. s. p. f.[1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945			66	$15,836	2	$222	(2)	$2	23	$18,938
1946	50	$16,205	145	23,428	38	1,539	(3)	2	11	8,991
1947	(3)	20	136	34,799	3	348	(4)	5	6	4,335
1948			282	82,305	6	787			9	7,809
1949	(5)	2	192	61,385	6	852	358	9,928	9	7,601

[1] Magnesium silicofluoride or fluosilicate and calcined magnesium sulfate included with "magnesium salts and compounds, n. s. p. f."
[2] 20 pounds. [3] 198 pounds. [4] 138 pounds. [5] 50 pounds.

TECHNOLOGY

There were reports of a promising new catalyst for use in fluid catalyst cracking. This material is synthetic silica-magnesia. Test results indicate it to be superior to silica-alumina and treated natural clay with respect to gasoline yield and activity maintenance. Gasoline octane numbers, however, are lower than those obtained with silica-alumina. Results of pilot plant testing were summarized.[7]

The composition, expansion characteristics, properties, and quality control of refractory linings in induction furnace steel making were discussed in an article.[8]

The addition of volatilized silica to Sorel cement to improve the strength, volume stability, and resistance to moisture was the subject of a patent.[9]

A refractories handbook describes the forms of refractories and their uses, how they are made and the types available, properties of refractories and the construction of furnaces, and technical data.[10]

A comprehensive article on the production of sea-water magnesia was published.[11]

WORLD REVIEW

Austria.—The United States Element of the Allied Commission for Austria presented a study of the rehabilitation of Austria, which contains a description of the economic development of Austria and a detailed discussion of the mining industry.[12]

The following magnesite operations were reported to be active in the latter part of 1949: Gr. Veitsch-Styria, Trieben-Styria, Breitenau-Styria, Kraubath-Styria, Oberdorf-Styria, Radenthein-Carinthia, Leogang-Land-Salzburg, Mayrhofen-Tyrol, and Fieberbrunn-Tyrol.[13]

Canada.—During the past 10 years Canada has expanded production of basic refractories sufficiently to supply its own needs and a surplus for exports. Dolomite and brucite are the raw materials of these refractories. A plant at Wakefield, Quebec, began production of magnesia from brucite in 1942. Products of this plant also are used for making magnesium metal at Arvid, and for agricultural and chemical purposes.[14]

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[7] Richardson, R. W., Johnson, F. B., and Robbins, L. V., Jr., Fluid Catalyst Cracking with Silica-Magnesia: Ind. Eng. Chem., vol. 41, No. 8, August 1949, pp. 1729–1733.

[8] Chesters, H. J., Mackenzie, J., and Lee, L., Refractory Linings for Induction Furnaces: Ceram. Age, vol. 54, No. 5, November 1949, pp. 280, 282–283, and vol. 54, No. 6, December 1949, pp. 374–375.

[9] Austin, L. W., and Rhodes, D. (Assigned to Permanente Metals Corp.), U. S. Patent 2,466,145, Apr. 5, 1949, from Jour. Am. Ceram. Soc., vol. 32, No. 10, Oct. 1, 1949, p. 224.

[10] Refractories, pub. by General Refractories Co., Philadelphia, Pa., 1949, 272 pp.

[11] Wicken, O. M., Production of Sea-Water Magnesite: Am. Inst. of Min. and Met. Eng., Proceedings of Electric Furnace Steel Conference, 1949 (1950), pp. 212–217.

[12] Rehabilitation of Austria, vol. II (Economic Section), United States Element of the Allied Commission for Austria.

[13] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 1, January 1950, p. 41.

[14] Mining Journal (London), vol. 233, No. 5948, Aug. 20, 1949, p. 763.

World production of magnesite, by countries,[1] 1943–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1943	1944	1945	1946	1947	1948	1949
Argentina				(2)	(2)	(2)	(2)
Australia:							
New South Wales	65,097	31,746	22,701	21,718	36,325	31,092	(2)
South Australia	804	467	752	657	1,003	893	574
Western Australia				11	74	977	2,067
Austria	494,400	480,500	93,200	95,400	223,200	405,600	520,500
Brazil	(2)	(2)	2,009	(2)	(2)	850	43,110
Cyprus (exports)	2	144	288	3	30	1	20
Czechoslovakia					173,300	(2)	(2)
Egypt	10	50	50			(2)	(2)
Germany: Federal Republic	39,937	[3 4] 20,000	(2)	(2)	(2)	(2)	11,264
Greece	680	950	1,650	4,500	13,700	12,168	25,250
India	49,858	42,609	28,793	45,394	52,363	49,103	[3] 45,000
Italy	5,670	1,490	494	613	1,691	1,002	456
Kenya		45	14	61	41	(2)	10
Korea:							
North	108,469	157,745	22,581	(2)	(2)	(2)	(2)
South							
Mexico	1			[5] 4,618	(2)	(2)	(2)
New Zealand	174	105	113	380	368	549	(2)
Norway	2,057	1,554	1,744	1,174	1,710	1,740	(2)
Poland	(2)	(2)	(2)	(2)	3,802	(2)	(2)
Southern Rhodesia	5,428	5,125	4,278	3,824	5,321	5,722	7,640
Spain	3,626	5,269	7,626	10,761	5,394	9,897	6,691
Turkey	137	797	798	100	860	3,407	4,870
Union of South Africa	14,038	5,433	7,079	7,003	8,415	10,660	10,487
United States	684,768	509,336	305,228	294,507	341,093	(6)	260,646
Venezuela	589	[3] 700	5,600	2,750	2,980	1,900	
Total (estimate)	2,300,000	2,000,000	1,200,000	1,200,000	1,600,000	1,800,000	1,900,000

[1] Unless otherwise stated, quantities in this table represent crude magnesite mined. In addition to countries listed, magnesite is also produced in Anglo-Egyptian Sudan, Canada, China, Cuba, U. S. S. R., and Yugoslavia, but data on tonnage of output are not available; estimates by senior author of chapter included in total.

The Canadian production was actually magnesitic dolomite and brucite, valued as follows: 1943: C$1,260,056; 1944: C$1,139,281; 1945: C$1,278,596; 1946: C$1,225,593; 1947: C$1,167,584; 1948: C$1,587,709.

[2] Data not available; estimate by senior author of chapter included in total.

[3] Estimate.

[4] January to June, inclusive.

[5] Exports.

[6] Bureau of Mines not at liberty to publish figure; included in total.

Greece.—Bandit activity on the Islands of Mytilini and Euboea were still hampering mining activity, although the security situation on Mytilini improved somewhat during 1949. An industrial loan for rehabilitating the Lesbos mine (Mytilini) was approved by the Central Loan Committee and was to provide for light mining equipment and construction of suitable loading facilities at the coast. The competitive position of Greece in relation to Yugoslavia and Turkey, two other magnesite producers, was summarized.[15]

Magnesite prospects near the airport of Salonika were reopened and a production of 25 to 30 tons daily was reported.[16]

India.—According to the Government of India, Japan has agreed to buy a substantial tonnage of magnesite from India under the trade agreement concluded between India and SCAP in Japan in 1948.[17]

Norway.—Construction was expected to begin late in 1949 on a magnesia plant at Norway's Heroya Kjemiske Fabried.[18]

Southern Rhodesia.—The discovery of an extensive deposit of magnesite northeast of Beitbridge, Southern Rhodesia,[19] was reported.

[15] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 2 August 1949, pp. 42–44.
[16] Foreign Commerce Weekly, vol. 36, No. 4, July 25, 1949, p. 32.
[17] Foreign Commerce Weekly, vol. 36, No. 10, Sept. 5, 1949, p. 38.
[18] Chemical Age (London), vol. 61, No. 1571, Aug. 20, 1949, p. 265.
[19] South African Mining and Engineering Journal, vol. 60, No. 2943, July 9, 1949, p. 635.

Manganese

By Norwood B. Melcher

GENERAL SUMMARY

EVENTS affecting supplies of manganese ore for United States use in 1949 were overshadowed by the loss of Russia as the principal supplier. Late in 1948 Russian suppliers notified importers in the United States that future shipments would be reduced to token quantities. As a consequence, imports from Russia—which totaled 427,229 net tons or one-third of total receipts in 1948—dropped to 81,459 tons in 1949. Domestic consuming industry as well as the United States Government turned attention to other world sources to provide adequate tonnages for current consumption as well as stock piling. Government efforts were coordinated through a high-level interagency group known as the Interdepartmental Manganese Coordination Committee. James Boyd, Director of the Bureau of Mines, was named chairman of the committee, and a world-wide program was inaugurated to increase the supplies of this highly strategic commodity. As a result of cooperative efforts of industry and Government, the loss of the Russian supply was not only replaced from other sources, but total imports in 1949 of all grades increased 23 percent over 1948. Virtually all of these added imports were necessarily obtained by expansion in currently producing areas, and much of the increased tonnage was obtained from Gold Coast, India, and the Union of South Africa. Other sources increased their shipments wherever possible; and, with reduced United States consumption in 1949, industry was able to increase its inventories substantially. In spite of this progress in 1949 in the supply position, the important requirements for stock piling lagged, and the market remained strong at the close of the year. Consequently, efforts to expand existing sources still further and to speed new developments were intensified. It is not expected that any important new sources will reach full production in 1950, but increases in both Indian and South African shipments were anticipated for this year.

Salient statistics of the manganese industry in the United States, 1945–49, gross weight in short tons

	1945	1946	1947	1948	1949
Manganese ore (35 percent or more Mn):					
Mine shipments:					
Metallurgical ore	174,295	134,381	125,428	119,828	110,928
Battery ore	8,042	[1] 8,295	6,189	10,845	14,983
Miscellaneous ore	----------	959	10	427	224
Total mine shipments	182,337	143,635	131,627	131,100	126,135
General imports	1,461,945	1,749,223	1,541,818	1,256,597	1,544,526
Consumption	1,485,859	1,136,687	1,419,131	1,538,398	1,360,042
Ferromanganese:					
Domestic production	619,760	491,973	614,626	647,617	577,345
Imports for consumption	35,521	32,130	81,307	98,220	65,014
Exports	836	2,951	20,168	19,696	6,627
Consumption	641,622	501,260	662,214	670,774	617,645
Spiegeleisen:					
Domestic production	139,039	111,696	134,329	112,610	78,167
Imports for consumption	3,146	321	----------	----------	1,737
Exports	2,393	7,513	305	51	----------
Consumption	148,037	112,700	120,019	102,392	75,841

[1] A small quantity of miscellaneous ore is included with battery ore.

India is the greatest potential source of manganese ore, except Russia, with its vast reserves of metallurgical-grade ore. From a standpoint of reserves, India probably could increase its exports to 1,000,000 tons annually, but serious transportation limitations would have to be overcome. The Gold Coast raised its exports to the United States from 132,681 tons in 1948 to 371,314 tons (including 55,832 tons of battery-grade ore) in 1949; this was an increase of 180 percent, but further expansion of this source is not considered feasible. Imports of ferromanganese made principally from Gold Coast ore decreased from 98,220 tons in 1948 to 65,014 tons in 1949. In terms of manganese ore, this is equivalent to a loss of 66,000 tons, which may have made possible, in part, the increase in imports of ore from that country. The Union of South Africa is capable of further expansion as a source of manganese ore; United States imports increased from 216,575 tons in 1948 to 354,265 tons in 1949, an increase of 64 percent. It is expected that imports will be increased further in 1950 to more than 500,000 tons as a result of increased railroad-car capacity supplied for this purpose during late 1948 and early 1949. On the other hand, South African manganese ore, while of metallurgical grade, requires blending with other ores to make a suitable feed for ferromanganese blast furnaces. Much of this ore averages 40 percent Mn content, with high iron. Brazil increased its exports from existing manganese mines 5 percent above the 1948 total, while work progressed in the development of the Amapa and Morro do Urucum deposits. Small shipments were scheduled for 1950 from Urucum, but transportation difficulties are still a major problem. In the Territory of Amapa, development is under way, and plans are being expedited for the construction of transportation facilities from the manganese deposits to the Amazon River port of Macapa. No accurate estimate can yet be made as to when large production from the new mines can be realized. The Belgian Congo has substantial reserves of manganese ore, as yet undeveloped, in the upper Lulua River Valley. Negotiations are under way for mining these ores, and the future probably will see substantial production in this area.

Manganese mines in the United States produced 4 percent less ore in 1949 than in 1948. A trend toward a greater percentage of battery-grade material continued, with 14,983 short tons shipped in 1949 compared with 10,845 tons in 1948. Montana continued to be the principal producing State; however, numerous small operators in nine other States shipped small lots of high- and low-grade ores. The Bureau of Mines expanded its technical research for improved methods of beneficiating low-grade ores and recovering manganese from steel-plant wastes.

The total value of manganese ore produced in the United States advanced approximately 18 percent during 1949. The import duty remained unchanged at one-fourth cent per pound of contained manganese.

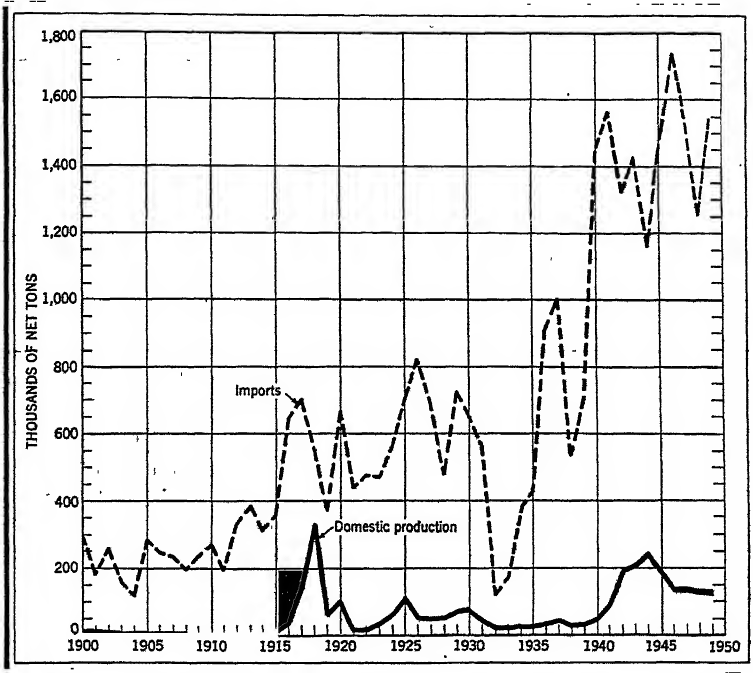

FIGURE 1.—General imports and domestic production (mine shipments) of manganese ore, 1900–1949.

DOMESTIC PRODUCTION

The following table shows the various types of manganiferous materials shipped by domestic producers from 1945 to 1949:

Manganiferous raw materials shipped by producers in the United States, 1945–49, in short tons

Year	Metallurgical ore				Battery ore (25 percent or more Mn)	Miscellaneous ore	
	Manganese ore (35 percent or more Mn)	Ferruginous manganese ore (10 to 35 percent Mn)	Manganiferous iron ore (5 to 10 percent Mn)	Manganiferous zinc residuum		35 percent or more Mn	10 to 35 percent Mn
1945	174,295	114,327	1,408,527	224,331	8,042	----------	----------
1946	134,381	100,402	1,070,694	205,786	[1] 8,295	[1] 959	87
1947	125,428	128,562	1,044,961	227,547	6,189	10	832
1948	119,828	139,580	1,198,523	291,383	10,845	427	2,462
1949	110,928	24,885	1,052,231	158,902	14,983	224	1,279

[1] A small quantity of miscellaneous ore is included with battery ore.

Shipments of various grades of manganese-bearing ores during the last 5 years are given by States in the accompanying tables. In addition, battery and miscellaneous ores were produced in Montana and Virginia, and manganiferous zinc residuum was produced from New Jersey zinc ores.

Metallurgical manganese ore shipped from mines in the United States, 1945–49, by States, in short tons

State	1945	1946	1947	1948	1949	State	1945	1946	1947	1948	1949
Ala.	32					N. Mex.	3,334	1,166	858		
Ariz.	1,093		133	240	223	S. C.	41	78			
Ark.	6,663	1,101	841	212	2,851	Tenn.			39	37	175
Calif.	1,668				280	Va.	8,566	321			
Ga.	1,056					Wash.	6,994	1,424			
Mont.	143,888	129,227	123,490	119,339	107,399						
Nev.	960	1,064	67			Total	174,295	134,381	125,428	119,828	110,928

Ferruginous manganese ore shipped from mines in the United States, 1945–49, by States, in short tons

State	1945	1946	1947	1948	1949	State	1945	1946	1947	1948	1949
Ariz.	56		62			Nev.	2,212	12,468	13,117	8,707	4,964
Ark.	14,806	1,964	2,094	1,165	5,555	N. Mex.	85,744	72,299	97,007	122,879	
Calif.	12				386	Tenn.	1,000				
Colo.	47		37			Utah	5,001	7,903	7,198	2,694	4,981
Mich.		1,952				Va.	392	87	6,208	2,462	1,279
Minn.					3,482						
Mont.	5,057	3,816	3,671	4,135	5,517	Total	114,327	100,489	129,394	142,042	26,164

Manganiferous iron ore shipped from mines in the United States, 1945–49, by States, in short tons

State	1945	1946	1947	1948	1949
Michigan	1,680				
Minnesota	1,406,847	1,070,694	1,044,961	1,198,523	986,720
New Mexico					65,511
Total	1,408,527	1,070,694	1,044,961	1,198,523	1,052,231

Arizona.—The Denison Manganese Co. shipped manganese ore containing (natural) 47 percent Mn from the Long Valley and Heber mines in Coconino County, Ariz.

Arkansas.—The Denison Manganese Co. and the Standard Ore & Alloys Co. shipped manganese ore containing (natural) over 45 percent Mn, and ferruginous manganese ore containing (natural) less than 35 percent Mn, from various mines in the Batesville-Cushman district, Ark.

California.—From Plumas County, Calif., the Utah Construction Co. and Western Manganese mines shipped manganese ore containing (natural) 40 percent Mn, and ferruginous manganese ore containing (natural) 17 percent Mn. The Owl Springs Co. shipped ferruginous manganese ore from Manix in San Bernardino County. All production was intermittent, and shipments were small.

Minnesota.—Manganiferous ores from Minnesota are mined on the Cuyuna range and usually average less than 10 percent Mn. However, in 1949, the Hanna Coal & Ore Corp. shipped 3,482 tons averaging (natural) 11.11 percent Mn. In addition, the above company, Pickands-Mather & Co., and Butler Bros. shipped 986,720 tons averaging 5.8 percent Mn.

Manganese and manganiferous ores shipped from mines in the United States in 1949, by States

	Metallurgical			Battery			Miscellaneous			Total			
	Shippers	Short tons		Shippers	Short tons		Shippers	Short tons		Shippers	Short tons		Value
		Gross weight	Manganese content		Gross weight	Manganese content		Gross weight	Manganese content		Gross weight	Manganese content	
Manganese ore: [1]													
Arizona	1	223	105							1	223	105	(2)
Arkansas	2	2,851	1,284							2	2,851	1,284	(2)
California	1	280	121							1	280	121	(2)
Montana	2	107,399	63,002	2	14,983	6,082				4	122,382	69,084	$5,068,425
Tennessee	1	175	101							1	175	101	(2)
Virginia							1	224	82	1	224	82	(2)
Total	7	110,928	64,613	2	14,983	6,082	1	224	82	10	126,135	70,777	5,178,564
Ferruginous manganese ore: [3]													
Arkansas	1	5,555	1,388							1	5,555	1,388	(2)
California	2	386	80							2	386	80	(2)
Minnesota	1	3,482	386							1	3,482	386	(2)
Montana	1	5,517	1,289							1	5,517	1,289	(2)
Nevada	4	4,964	1,323							4	4,964	1,323	52,990
Utah	10	4,981	1,006							10	4,981	1,006	39,983
Virginia							1	1,279	381	1	1,279	381	(2)
Total	19	24,885	5,472				1	1,279	381	20	26,164	5,853	257,330
Manganiferous iron ore: [4]													
Minnesota	3	986,720	57,328							3	986,720	57,328	(5)
New Mexico	1	65,511	5,711							1	65,511	5,711	(5)
Total	4	1,052,231	63,039							4	1,052,231	63,039	3,782,825

[1] Containing 35 percent or more manganese (natural).
[2] Value included in total
[3] Containing 10 to 35 percent manganese (natural).
[4] Containing 5 to 10 percent manganese (natural).
[5] Bureau of Mines not at liberty to publish figures.

Montana.—In 1949, Montana supplied 97 percent of all domestic manganese ore, including battery-grade ore. The largest producer, Anaconda Copper Mining Co., produced crude ore from the Butte Hill and Emma mines in Silver Bow County and processed this into nodules containing (dry) 59.1 percent Mn. This company is now successfully producing electric ferromanganese at Anaconda and Black Eagle from its own ores while still supplying eastern furnaces with some of its nodules. In the Philipsburg district, the Taylor-Knapp Co. and the Trout Mining Division of American Machine & Metals, Inc., produced battery-grade concentrates from the Moorlight and Trout groups of mines, respectively. The ore averaged (natural) 66-percent MnO_2. A lower-grade manganese middling averaging (natural) 23.36 percent Mn was also produced in the Philipsburg area.

Nevada.—Four operators produced ferruginous manganese ore averaging (natural) 26.6 percent Mn from mines in Nevada. The Charleston Hill National Mines Co. operating the Black Diablo mine in Pershing County supplied 88 percent of the ore. Blast furnaces at Geneva, Utah, received the shipments.

New Mexico.—Manganiferous ore averaging (natural) slightly below 10 percent Mn was shipped by the Luck Mining & Construction Co. from the Boston Hill mine in Grant County, N. Mex., to furnaces in Pueblo, Colo.

Tennessee.—The Hambright mine in Bradley County, Tenn., shipped a small lot of high-grade concentrates to blast furnaces in the Birmingham area.

Utah.—Ten operators produced ferruginous manganese ores averaging (natural) 20.2 percent Mn from various locations for furnaces at Geneva and Provo, Utah. Shipping points were Delta, Thompson, Stone, Eureka, St. Johns, and Tintic.

Virginia.—The Dominion Manganese Corp. continued to produce small quantities of concentrates from tailings at its mine in Augusta County, Va. In addition, R. M. Green shipped ore containing over 44 percent Mn from Harlow in Campbell County.

CONSUMPTION AND STOCKS

Substantially reduced requirements during 1949 resulted in a 12-percent decrease in the consumption of manganese ore. Domestic mines supplied 10 percent and foreign sources 90 percent, compared with 8 and 92 percent, respectively, in 1948. Three percent was consumed in the manufacture of dry cells, 1 percent went into chemicals, and 96 percent was used in the metals industry. Industry stocks rose from 640,842 tons on December 31, 1948, to 928,349 tons at the end of 1949, an increase of 45 percent. However, these stocks were unevenly distributed, and the demand for ore continued high. The following table shows ores available for consumption in the United States in 1949, without adjustments for changes in consumer or Government stocks.

Indicated consumption of manganiferous raw materials in the United States in 1949

	Ore containing 35 percent or more Mn		Ore and residuum containing 10 to 35 percent Mn		Ore containing 5 to 10 percent Mn	
	Short tons	Mn content (percent)	Short tons	Mn content (percent)	Short tons	Mn content (percent)
Domestic shipments	126,135	56.11	185,066	19.5	1,052,231	5.99
Imports for consumption	1,423,844	46.64	27,266	32.0	[1] 67,466	5.18
Total available for consumption	1,549,979	47.41	212,332	21.1	1,119,697	5.94

[1] Estimated from consumption.

The following table shows the actual tonnages of manganese ore (containing 35 percent or more manganese, natural) and manganese alloys consumed during 1948 and 1949, by type of consumer, together with stocks at the end of the year.

Consumption of manganese ore and manganese alloys in the United States, 1948–49, and stocks Dec 31, 1949, gross weight in short tons

	Consumed		In stock Dec. 31, 1949 [1]	
	1948	1949	At plant, including bonded warehouses	In bonded warehouses only
Manufacturers of manganese alloys and manganese metal:				
Manganese ore:				
Domestic	112,746	129,980	38,848	
Foreign	1,302,133	1,135,202	815,337	631,210
Total manganese ore	1,414,879	1,265,182	854,185	631,210
Ferromanganese			51,707	27,296
Spiegeleisen			17,873	
Silicomanganese			(2)	(2)
Manganese briquets			(2)	(2)
Manufacturers of steel ingots and steel castings: [3]				
Manganese ore:				
Domestic	1,940	1,196	691	
Foreign	3,447	2,542	1,308	
Total manganese ore	5,387	3,738	1,999	
Ferromanganese:				
High-carbon	606,635	559,084	86,984	
Medium-carbon, Low-carbon	25,640	28,306	5,763	
Total ferromanganese	632,275	587,390	92,747	
Spiegeleisen	75,266	57,693	36,848	
Silicomanganese	64,110	56,055	8,663	
Manufacturers of steel castings: [4]				
Manganese ore:				
Domestic	758	35	273	
Foreign	712	491	713	
Total manganese ore	1,470	526	986	

See footnotes at end of table.

Consumption of manganese ore and manganese alloys in the United States, 1948–49, and stocks Dec. 31, 1949, gross weight in short tons—Continued

	Consumed		In stock Dec. 31, 1949 [1]	
	1948	1949	At plant, including bonded warehouses	In bonded warehouses only
Manufacturers of steel castings [4]—Continued				
Ferromanganese:				
High-carbon	27, 236	19. 157	4, 786	-----------
Medium-carbon } Low-carbon	1, 316	1, 051	430	-----------
Total ferromanganese	28, 552	20, 208	5, 216	-----------
Spiegeleisen	13, 412	8, 182	1, 112	-----------
Silicomanganese	9, 779	6, 362	1, 546	-----------
Manufacturers of pig iron:				
Manganese ore:				
Domestic	828	210	436	-----------
Foreign	50, 695	39, 476	30, 003	-----------
Total manganese ore	51, 523	39, 686	30, 439	-----------
Manufacturers of miscellaneous products:				
Ferromanganese:				
High-carbon	7, 270	7, 203	2, 267	-----------
Medium-carbon } Low-carbon	2, 677	2, 844	1, 020	-----------
Total ferromanganese	9, 947	10, 047	3, 287	-----------
Spiegeleisen	13, 714	9, 966	2, 929	-----------
Silicomanganese	1, 537	910	289	-----------
Manganese briquets	11, 941	8, 427	2, 168	-----------
Manufacturers of dry cells:				
Manganese ore:				
Domestic	5, 747	3, 747	1, 219	-----------
Foreign	42, 253	30, 722	27, 155	10, 474
Total manganese ore	48, 000	34, 469	28, 374	10, 474
Manufacturers of chemicals:				
Manganese ore:				
Domestic	686	5, 373	4, 006	-----------
Foreign	16, 453	11, 068	8, 360	-----------
Total manganese ore	17, 139	16, 441	12, 366	-----------
Grand total:				
Manganese ore:				
Domestic	122, 705	140, 541	45, 473	-----------
Foreign	1, 415, 693	1, 219, 501	882, 876	641, 684
Total manganese ore	[5] 1, 538, 398	[5] 1, 360, 042	928, 349	641, 684
Ferromanganese:				
High-carbon	641, 141	585, 444	} 152, 957	27, 296
Medium-carbon } Low-carbon	29, 633	32, 201		
Total ferromanganese	670, 774	617, 645	152, 957	27, 296
Spiegeleisen	102, 392	75, 841	58, 762	-----------
Silicomanganese	75, 426	63, 327	[6] 10, 498	-----------
Manganese briquets	11, 941	8, 427	[6] 2, 168	-----------

[1] Excluding Government stocks.
[2] Data not available.
[3] Includes only that part of castings made by companies that also produce steel ingots.
[4] Excludes companies that produce both steel castings and steel ingots.
[5] The greater part of the consumption of ore was used in the manufacture of ferromanganese and silicomanganese. Combining consumption of ore with that of ferromanganese and silicomanganese would result in duplication.
[6] Excludes small tonnages of producers' stocks.

The consumption of manganese per short ton of steel manufactured in 1949 was 13.2 pounds, as in 1947. In 1948 the ratio was 12.7 pounds per ton of steel. The variation is considerable because of the large tonnages involved and is explained by the use of manganese as an alloying element in addition to its primary use as a sulfur counteractant. Manganese alloy steels range up to 14 percent Mn, and relatively small tonnages of these alloys will affect the ratio materially. Of the 13.2 pounds used per ton of steel, 11.8 pounds was in the form of ferromanganese, 1.0 pound as silicomanganese, 0.3 pound as spiegeleisen, and 0.1 pound as ore. These data apply to consumption of manganese in the manufacture of steel ingots and that part of steel castings manufactured by companies that also produce steel ingots. The companies reporting in this part of the survey are the same as those reporting production of ingots and castings to the American Iron and Steel Institute.

Electrolytic Manganese.—The Electro Manganese Corp., Knoxville, Tenn., was the only producer of electrolytic manganese during 1949.

Ferromanganese and spiegeleisen imported into and made from domestic and imported ores in the United States, 1948–49, in short tons

	1948		1949	
	Alloy	Manganese content	Alloy	Manganese content
Ferromanganese:				
Imported	98,220	78,426	65,014	52,167
Domestic production	647,617	507,843	577,345	452,249
From domestic ore (estimated)	50,313	39,455	65,671	52,537
From imported ore (estimated)	597,304	468,388	511,674	399,712
Total	745,837	586,269	642,359	504,416
Ratio (percent) of Mn in ferromanganese of domestic origin to total Mn in ferromanganese made and imported		6.73		10.4
Number of plants making ferromanganese	10		10	
Spiegeleisen:				
Imported			1,737	313
Domestic production [1]	112,610	27,682	78,167	16,787
Total	112,610	27,682	79,904	17,100
Ratio (percent) of Mn in spiegeleisen of domestic origin to total Mn in spiegeleisen made and imported		100.0		98.17
Number of plants making spiegeleisen	3		4	
Total available supply of metallic manganese in ferromanganese and spiegeleisen		613,951		521,516
Percent of available supply of manganese in:				
Ferromanganese and spiegeleisen imported		12.77		10.06
Ferromanganese made from imported ore		76.29		76.64
Spiegeleisen made from imported ore				
Ferromanganese made from domestic ore		6.43		10.07
Spiegeleisen made from domestic ore		4.51		3.22
Ferromanganese and spiegeleisen made from domestic ore		10.94		13.29
Spiegeleisen made and imported		4.51		3.28
Open-hearth, bessemer, and electric steel produced	88,640,470		77,978,176	

[1] None produced from foreign ore in 1948–49.

Ferromanganese.—Output of ferromanganese in the United States was off 11 percent to 577,345 short tons in 1949 compared with 647,617 tons in 1948. The following plants were active producers during the year: Bethlehem Steel Co., Johnstown, Pa.; Anaconda Copper Mining Co., Black Eagle, Mont.; the Electro Metallurgical Division of the Union Carbide & Carbon Corp., Ashtabula, Ohio, and Alloy, W. Va.;

E. J. Lavino & Co., Reusens, Va., and Sheridan, Pa.; Sloss-Sheffield Steel & Iron Co., North Birmingham, Ala.; and Carnegie-Illinois Steel Corp., Clairton and Etna, Pa. Manganese ore consumed in the manufacture of ferromanganese totaled 1,169,369 short tons in 1949. Of this quantity, 10 percent was of domestic origin and 90 percent foreign. The domestic contribution in 1948 was six percent and in 1947, nine. The recovery of manganese from ore in making ferromanganese was 83.3 percent in 1949 compared with 84.6 percent in 1948 and 84.8 percent in 1947. Shipments of ferromanganese from producing furnaces in 1949 fell 15 percent in quantity and 4 percent in value from 1948. The following table gives shipments and values for the past 5 years.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1945–49

Year	Ferromanganese produced			Materials consumed (short tons)			Manganese ore used per ton of ferromanganese made (short tons)
	Short tons	Manganese contained		Manganese ore (35 percent or more Mn, natural)		Iron and manganiferous iron ores	
		Percent	Short tons	Foreign	Domestic		
1945	619,760	79.00	489,603	1,111,075	120,420	5,364	1.987
1946	491,973	78.69	387,112	883,383	80,377	4,829	1.959
1947	614,626	78.67	483,509	1,075,043	109,987	1,340	1.928
1948	647,617	78.42	507,843	1,209,249	78,702	5,930	1.989
1949	577,345	78.33	452,249	1,054,445	114,924	2,540	2.025

Manganese ore used in manufacture of ferromanganese in the United States, 1945–49, by source of ore

Source of ore	1945		1946		1947		1948		1949	
	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)
Domestic	120,420	57.05	80,377	58.66	109,987	59.53	78,702	59.26	114,924	59.13
Foreign:										
Africa	280,264	46.15	323,225	47.18	313,027	47.35	386,503	46.69	367,339	46.24
Brazil	275,117	41.19	161,456	40.98	139,300	40.49	159,668	40.81	138,917	40.76
Chile	5,498	45.42	2,194	47.45	8,298	47.23	5,195	47.91	3,838	47.78
Cuba	257,521	45.37	165,951	46.53	74,102	44.00	35,328	42.87	36,344	38.83
India	258,432	48.77	207,769	48.33	369,101	49.94	304,607	47.82	258,372	46.96
Mexico	21,791	43.86	22,492	47.23	33,382	41.16	40,420	41.79	27,952	40.81
Philippines					2,196	51.64	7,763	46.13	10,922	45.12
U. S. S. R.	12,452	44.49	296	44.59	135,637	47.71	269,765	46.08	210,761	44.91
Grand total	1,231,495	46.43	963,760	47.23	1,185,630	48.14	1,287,951	46.61	1,169,369	46.41

Ferromanganese shipped from furnaces in the United States, 1945–49

Year	Short tons	Value	Year	Short tons	Value
1945	610,376	$78,907,189	1948	659,193	$90,126,657
1946	493,808	61,355,778	1949	560,180	86,463,708
1947	614,647	79,972,673			

Spiegeleisen.—Production of spiegeleisen in the United States dropped sharply in 1949 to 78,167 short tons from 112,610 tons in 1948, a decrease of 31 percent. Shipments fell 51 percent in quantity, while value decreased 44 percent. The continued downward trend in the use of spiegeleisen is not encouraging when it is noted that ferromanganese is being substituted for this material. The strategic aspects of the high-grade alloy should discourage its use where unnecessary; however, the inconvenience of handling spiegeleisen compared with ferromanganese, the lesser degree of control possible, and the lack of sufficient price differential tend to push this material into the background.

Three companies produced spiegeleisen in four plants in 1949: New Jersey Zinc Co., Palmerton, Pa.; Inland Steel Co., East Chicago, Ind.; and Carnegie-Illinois Steel Corp., Etna, Pa., and Gary, Ind. No foreign materials were reported used in the manufacture of spiegeleisen in 1949.

Spiegeleisen produced and shipped in the United States, 1945–49

Year	Produced (short tons)	Shipped from furnaces		Year	Produced (short tons)	Shipped from furnaces	
		Short tons	Value			Short tons	Value
1945	139,039	157,774	$5,108,144	1948	112,610	108,960	$5,281,650
1946	111,696	114,982	3,793,673	1949	78,167	53,888	2,972,653
1947	134,329	124,517	4,980,030				

Manganiferous Pig Iron.—Pig-iron blast furnaces used 1,045,527 tons of manganese-bearing ores containing (natural) over 5 percent Mn in 1949. Of the ore used, 933,906 tons were of domestic and 111,621 tons of foreign origin. Of the domestic material used, 868,082 tons contained (natural) 5 to 10 percent Mn, 65,614 tons 10 to 35 percent Mn, and 210 tons contained more than 35 percent Mn. Of the foreign material used, 67,466 tons contained less than 10 percent Mn, 4,679 tons contained 10 to 35 percent Mn, and 39,476 tons contained more than 35 percent Mn.

Battery and Miscellaneous Industries.—Manufacturers of dry cells used 34,469 short tons of manganese ore during 1949; of this total, 3,747 tons were of domestic and 30,722 tons of foreign origin. Chemical plants used 16,441 tons, of which 5,373 tons were domestic and 11,068 tons were imported. All of the ore used contained (natural) more than 35 percent Mn. The principal use of chemical ore is in the manufacture of manganese sulfate fertilizer and of hydroquinone for photographic use. Manganese ore for battery use should have a high content of available oxygen with minimum iron and be relatively free from such metals as arsenic, nickel, copper, and cobalt, which are electronegative to zinc. Preferably, battery manganese ore should be poorly crystallized and consist of the gamma oxide known as cryptomelane.

Foreign ferruginous manganese ore and manganiferous iron ore consumed in the United States, 1946–49, in short tons

Source of ore	Ferruginous manganese ore				Manganiferous iron ore			
	1946	1947	1948	1949	1946	1947	1948	1949
Africa				4,673		44,227	24,074	67,466
Australia						1,558		
Mexico	257		52	6	5,854			
Palestine			10,376					
Total	257		10,428	4,679	5,854	45,785	24,074	67,466

PRICES

Manganese Ore.—Prices of manganese ore containing 48 percent Mn, as quoted by E&MJ Metal and Mineral Markets, at the beginning of 1949 ranged from 70.6 to 72.6 cents per long-ton unit, including duty f. o. b. eastern and southern ports. At the end of the year comparable prices ranged from 81.8 to 83.8 cents per unit. The long-ton unit upon which the price of manganese ore is based is 1 percent of a long ton (22.4 pounds) of contained manganese. Prices of chemical ore are given on a per-ton basis, with a minimum requirement of manganese dioxide. A duty of one-fourth cent per pound of contained manganese was imposed on all ores imported in 1949, except those from Cuba and the Republic of the Philippines, which entered duty free.

Manganese Alloys.—The average value, f. o. b. producers' furnaces, for ferromanganese shipped during 1949 was $154.35 per short ton, compared with $136.72 in 1948. According to Iron Age, the selling price of ferromanganese in carlots at eastern centers rose from $162 per gross ton, which had been in effect since October 1948, to $173.40 in December 1949; the average for the year was $171.08. The value of spiegeleisen, f. o. b. domestic furnaces, was $55.16 per short ton compared with $48.29 in 1948; and the quoted price, as given by Iron Age, rose from $62.00 per gross ton at the beginning of the year to $63.20 in March and to $65 in April, then remained unchanged during the balance of the year. The average quoted price per gross ton was $64.35 in 1949.

FOREIGN TRADE [1]

Imports of all grades of manganese are shown by countries in the accompanying table. The data include imports of battery-grade ore totaling 77,284 short tons in 1949. Of this quantity, 55,832 tons came from Gold Coast, 11,025 tons from U. S. S. R., 5,055 tons from Cuba, 3,541 tons from India, 1,098 tons from French Morocco, 471 tons from Mexico, 200 tons from France, 56 tons from the United Kingdom, and 6 tons from Spanish Africa. This ore averaged 53.73 percent Mn or 85 percent MnO_2. Imports for consumption of battery ore totaled 73,123 short tons valued at $1,966,039 or $26.89 per short ton f. o. b. foreign ports. Of the total, Gold Coast supplied

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Manganese ore (35 percent or more Mn) imported into the United States, 1948–49, by countries

[U. S. Department of Commerce]

Country	General imports [1] (short tons)				Imports for consumption [2]					
					Short tons				Value	
	Gross weight		Mn content		Gross weight		Mn content			
	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949
Angola	[3] 2,807	8,314	[3] 1,565	4,320	[3] 1,920	4,696	[3] 1,037	2,466	[3] $50,915	$126,581
Belgian Congo	2,688	3,304	1,371	1,692	2,688	6,492	1,371	3,191	65,393	131,424
Brazil	143,917	151,560	57,954	61,015	160,479	201,569	71,561	88,016	1,933,867	2,003,197
British East Africa					530		281		9,187	
Canada	348		177		348		177		11,025	
Chile	10,843	8,192	4,873	3,771	10,308	14,732	4,927	6,672	164,471	253,699
Cuba	32,843	60,812	15,931	27,314	32,843	60,812	15,931	27,314	810,321	1,302,459
France	1	200	(4)	100	1	200	(4)	100	245	59,078
Germany		(4)		(4)		(4)		(4)		57
Gold Coast	[3] 132,681	371,314	[3] 70,149	180,529	[3] 217,874	281,829	[3] 112,346	138,472	[3] 3,261,502	4,745,154
India	213,445	429,203	103,217	207,495	314,799	357,163	152,852	172,504	4,331,225	7,248,492
Mexico	61,568	60,265	27,498	26,559	53,754	53,566	23,894	23,770	812,382	1,434,913
Morocco, French	300	1,432	166	798	300	1,432	166	798	12,696	56,935
Mozambique						572		283		9,246
Philippines	10,120	14,144	5,099	6,944	10,120	14,144	5,099	6,944	219,774	300,205
Portuguese Asia	1,109		455							
Spanish Africa		6		3		6		3		125
Turkey	33		17							
Union of South Africa	216,575	354,265	98,514	153,613	283,376	275,572	130,114	122,169	3,394,517	4,021,893
U. S. S. R.	427,220	81,459	201,409	38,933	384,118	151,003	182,455	71,358	8,242,804	3,845,115
United Kingdom		56		31		56		31		12,824
Total	1,256,597	1,544,526	588,393	713,117	1,473,453	1,423,844	702,211	664,091	23,320,324	26,460,397

[1] Comprises ore received in the United States during year; part went into consumption, and remainder entered bonded warehouses.
[2] Comprises receipts during year for consumption and ore withdrawn from bonded warehouses during year (irrespective of time of importation).
[3] Revised figure.
[4] Less than 1 ton.

55,014 tons; U. S. S. R., 11,025 tons; Cuba, 5,055 tons; French Morocco, 1,098 tons; Mexico, 471 tons; India, 198 tons; France, 200 tons; the United Kingdom, 56 tons; and Spanish Africa, 6 tons.

Imports for consumption of ferromanganese in 1949 decreased 33 percent under 1948; exports decreased 66 percent. Exports of manganese ore and concentrates amounted to 5,033 tons valued at $353,973.

Ferromanganese imported into and exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Imports for consumption [1]			Exports	
	Gross weight (short tons)	Mn content (short tons)	Value	Gross weight (short tons)	Value
1945	35,521	27,694	$3,733,846	836	$175,556
1946	32,130	25,908	4,493,056	2,951	381,194
1947	81,307	65,181	10,847,036	20,168	2,811,653
1948	98,220	78,426	14,516,593	19,696	2,990,645
1949	65,014	52,167	11,305,609	6,627	1,360,279

[1] All from Canada in 1945–49 except 1946: 9,357 tons (7,595 content), $1,585,803 from Norway; 1947: 12,607 tons (10,372 content), $2,149,139 from Norway; 1948: 25,904 tons (20,949 content), $4,558,912 from Norway; 1949: 32,407 tons (26,320 content), $6,534,494 from Norway, 11 tons (11 content), $2,543 from Japan, 14 tons (8 content), $1,407 from China, 56 tons (45 content), $4,670 from Korea.

Spiegeleisen imported for consumption in the United States, 1944–49

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1944	3,761	$153,032	1947–48		
1945	3,146	142,883	1949	1,737	$86,217
1946	321	17,512			

WORLD REVIEW

The accompanying table shows, insofar as statistics are available, the world production of manganese ores from 1943 to 1949 and their average manganese content. Official statistics of the countries are used, supplemented by data from semiofficial and other sources.

World production of manganese ore, by countries, 1943–49, in metric tons

[Compiled by Pauline Roberts]

Country [1]	Percent Mn	1943	1944	1945	1946	1947	1948	1949
North America:								
Canada (shipments)	---	44	---	---	---	204	3	---
Cuba	36–50+	[2] 311,214	[2] 257,864	198,247	130,764	50,397	29,073	62,503
Mexico	41–45	70,503	80,671	51,959	25,000	31,400	53,800	[3] 54,671
United States (shipments)	35+	186,129	224,632	165,412	130,303	119,409	118,931	114,427
South America:								
Argentina [4]	35–38	1,645	3,155	4,272	(5)	(5)	(5)	(5)
Bolivia (exports)	50	17	---	---	---	---	---	---
Brazil (exports)	38–50	275,552	146,983	244,649	149,149	142,092	141,253	(5)
Chile	40–50	114,074	43,989	7,445	20,538	19,352	20,498	(5)
Europe:								
Germany	30+	985	(5)	[6] 19,000	[6] 35,000	[6] 89,000	[7] 33,600	(5)
Greece	60–62	290	---	---	15	---	(5)	1,150
Hungary	35–48	33,580	[8] 21,050	[9] 6,600	14,780	33,470	[10] 40,000	(5)
Italy	34–37	45,070	23,909	3,297	8,400	26,530	24,689	24,219
Portugal	35–45	12,611	9,210	8,114	5,932	2,444	280	508
Rumania	30–36	37,417	(5)	(5)	18,807	(5)	[10] 47,000	[10] 65,000
Spain	40+	26,150	30,426	24,889	29,589	22,429	18,525	[10] 19,000
Sweden	30+	26,703	24,276	18,036	12,594	10,697	8,417	(5)
Switzerland	---	8,138	5,778	2,757	(5)	---	---	---
U. S. S. R. (estimate)	41–48	1,000,000	461,000	2,251,000	1,700,000	1,800,000	(5)	(5)
United Kingdom	30+	20,558	17,890	11,480	---	---	---	(5)
Asia:								
Burma (estimate)	35	762	762	762	(5)	(5)	(5)	(5)
China	41	[11] 10,475	[11] 9,880	16,400	[12] 9,600	20,000	[10] 22,000	(5)
French Indochina	47–50	1,452	7,719	---	---	---	---	(5)
India	47–52	604,922	376,934	213,963	256,975	458,274	474,260	[13] 551,828
Indonesia	---	7,112	7,112	7,112	---	---	---	(5)
Japan	32–40	[14] 342,884	[14] 400,679	[14] 85,700	29,394	29,398	48,091	92,947
Korea	---	(5)	32,377	(5)	(5)	(5)	(5)	(5)
Malaya	30	2,540	2,540	2,540	---	---	---	---
Philippines	35–48	(5)	(5)	(5)	---	3,375	25,565	26,288
Portuguese India	32–50+	---	---	---	(5)	[13] 100	[13] 4,728	(5)
Turkey	30–50	2,684	1,865	4,895	1,185	4,633	8,327	16,702
Africa:								
Angola	50	4,000	2,000	---	1,900	700	400	(5)
Belgian Congo	50+	17,411	2,983	2,561	12,231	17,646	12,765	[13] 16,286
Egypt	30+	7,079	30	47	25	29	59,919	138,000
French Morocco	32–50	49,010	27,550	44,458	57,990	114,290	214,412	233,830
Gold Coast [2]	50+	534,362	479,499	[13] 713,013	[13] 777,583	[13] 598,655	[13] 640,088	[13] [15] 285,501
Southern Rhodesia	---	---	---	---	---	---	998	166
Tunisia	35–40	---	313	---	---	25	---	---
Union of South Africa	40–50	219,122	106,883	114,546	237,897	288,213	276,393	655,181
Oceania:								
Australia:								
New South Wales	---	614	782	1,000	1,407	1,612	1,577	(5)
Queensland	---	57	209	---	---	---	---	(5)
South Australia	---	5,680	1,219	---	---	192	254	(5)
Western Australia	---	---	---	---	---	---	1,671	(5)
New Zealand	---	518	---	---	408	---	533	(5)
Papua	---	365	176	174	44	83	(5)	(5)
Total (estimate)	---	4,030,000	2,850,000	4,240,000	3,673,000	3,900,000	4,133,000	4,530,000

[1] In addition to countries listed, Belgium, Bulgaria, Costa Rica, Eritrea, Iran, Spanish Morocco, and Yugoslavia have produced manganese ore; but data of output are not available, and no estimates for them are included in the totals. Czechoslovakia and Northern Rhodesia report production of manganese ore, but as it has been ascertained that the product so reported averages less than 30 percent Mn and therefore would be considered ferruginous manganese ore under the classification used in this report, the output has not been included in the table.

[2] Dry weight.

[3] U. S. imports from Mexico.

[4] Shipments by rail and river.

[5] Data not available; estimate by author of chapter included in total.

[6] French zone only.

[7] Bizonal area.

[8] January to June, inclusive.

[9] June to December, inclusive.

[10] Estimate.

[11] Japanese imports from China.

[12] Incomplete data.

[13] Exports.

[14] Fiscal year ended March 31 of year following that stated.

[15] January to May, inclusive.

Australia.—Consumption of manganese ore in Australia greatly exceeds its small production. In past years the Commonwealth has received most of its imports from India. In 1949, however, some 10,000 tons of ore were reported received from Russia, enough to supply Australia's needs for more than a year. This delivery was made to the Broken Hill Co. Pty., Ltd.[2] Domestic production in Australia comes largely from the Horseshoe deposits, 419 miles from Geraldton, although Broken Hill contracted for 2,000 tons of Queensland ore from Imbil, about 40 miles south of Maryborough.[3]

Belgian Congo.—Production continued at the Kasokelesa mines in Katanga in 1949. A deposit in the upper Lulua River Valley, believed to contain large reserves of high-grade metallurgical ore, was prospected during the year. The exploitation of these reserves would require extensive development and construction of a railroad to the area.

Brazil.—Production of manganese ore in Brazil was restricted largely to the Morro de Mina deposit in Minas Gerais, with some small production in Bahia. There are, however, two large potential locations in remote areas of Brazil which promise large production in the future. The first of these is the Urucum deposit in the State of Mato Grosso near the Bolivian border. This deposit contains over 33,000,000 gross tons averaging 45.6 percent Mn and 11.1 percent Fe. A disadvantage of this area, however, is its location, causing serious transportation problems. Some ore from this area could be transported by rail about 700 miles to Santos for reshipment. However, most of the material would be barged down the Paraguay River approximately 1,700 miles to the Plata Estuary for transfer to ocean vessels.[4] This deposit is currently under development by the United States Steel Corp.

The second large potential manganese-producing area in Brazil is the Serra do Navio district in the Territory of Amapa in northern Brazil. These deposits are on the banks of the Amapari River about 240 kilometers from Macapa on the Amazon River. The reserves have been estimated by Dorr and others[5] at 7,385,000 metric tons averaging 48.36 percent Mn and 5.96 percent Fe. Later development work indicates that the reserves may greatly exceed the above estimate. This area is under development by the Bethlehem Steel Co., and again a serious transportation problem is involved; a railroad must be constructed from the deposit to Macapa, or facilities must be installed for barging down the Amapari to Porte Grande and then transshipment to Macapa by rail or truck. Deep water is available at Macapa.

Chile.—Chilean manganese production is now small but could be increased to several times its present rate by accumulating and blending ores from many small deposits having a wide range in analysis.

Gold Coast.—All the production of manganese ore from Gold Coast comes from the Nsuta mine. Operations were at capacity of 60,000

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[2] Engineering and Mining Journal, vol. 150, No. 8, August 1949, p. 129.
[3] Engineering and Mining Journal, vol. 150, No. 10, October 1949, p. 146.
[4] Dorr, John Van N., II, Manganese and Iron Deposit of Morro do Urucum, Mato Grosso, Brazil: U. S. Geol. Survey Bull. 946A, 1945, 47 pp.
[5] Dorr, John Van N., II, Park, Charles F., Jr., and Paiva, Glycon de, Manganese Deposits of the Serra do Navio District, Territory of Amapa, Brazil: U. S. Geol. Survey Bull. 964A, 1949, 51 pp.

tons per month throughout 1949. Ores from the mine are high-grade, being used for metallurgical, battery, and chemical purposes. Fine ore is sintered in a Dwight-Lloyd plant. Other manganese deposits in Gold Coast are of uncertain grade and tonnage.

India.—Production and exports of manganese ore from India have risen sharply since the early postwar years. This has been possible through improvement in the railroad transportation in India brought about by the addition of new rolling stock but, more important, by improved administration of existing facilities. A board of 12 members has successfully programed a more efficient use of the entire Indian rail system. Manganese-ore exports are licensed by the Indian Government, and most of the 1949 quota of 400,000 gross tons for export to the United States was attained. Moreover, it appeared at the end of 1949 that the new 500,000-ton quota for 1950 also had a reasonable chance of being filled. The United States and the United Kingdom received most of India's exports, but Belgium, Italy, France, Japan, and Germany also received substantial tonnages. Central Provinces contain the most important reserves of high-grade manganese ore in India, amounting to many millions of tons. New deposits in Kutingi and near Ambodala were described by Corry.[6] It was stated that an annual output of 50,000 tons should be possible from Kutingi and 20,000 to 30,000 tons per year from the Ambodala deposit; both are near the Bengal-Nagpur Railway. Most of the manganese exports from India are loaded in the port of Vizagapatam, which can handle 50,000 tons per month.

Mexico.—Mexican exports of manganese ore in 1948, most of which came from the Lucifer mine in Lower California, totaled 57,464 metric tons compared with 42,048 tons in 1947; all went to the United States.[7]

U. S. S. R.—The Soviet Union is probably the world's largest producer of manganese despite its present policy of exporting relatively very small tonnages. The deposits in Russia occur in two main areas, Nikopol and the Caucasus; normally the latter area provides the export material, and Nikopol mainly the ore for domestic consumption. The U. S. S. R. is the only large steel-producing nation of the world that is self-sufficient in manganese, and, due to its favorable position with respect to large reserves, it uses proportionately more manganese than any other large industrial nation. It is known that Russia uses manganese for alloying purposes to a far greater extent than does the United States; and, based on known steel analyses of Russian production, it is probable that the total consumption in Russia approximates 1,000,000 tons per year, or two-thirds that of the United States, whereas its steel capacity is less than one-third. Inasmuch as Russian exports are low, it is not unlikely that manganese ore from the Caucasus is being stock-piled at steel centers east of the Ural Mountains. The offering of Russian ferromanganese on the European market has been reported.

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[6] Corry, Andrew V., American Consulate General, Calcutta, Rept. 32, Apr. 2, 1949.
[7] Metal Bulletin (London) No. 3417, Aug. 19, 1949, p. 13.

Mercury

By Helena M. Meyer and Alethea W. Mitchell

GENERAL SUMMARY

CONSUMPTION of mercury in 1949, although 14 percent less than in 1948, was at a peacetime record rate except for that year. This favorable factor, however, was not enough to bring prosperity to the domestic mercury-mining industry; prices trended downward from the beginning to the end of the year, and domestic production dropped 31 percent to the lowest level since 1933. Imports of mercury for consumption were unprecedented, being over three times as large as in 1948 and 50 percent above the previous record in 1945. A very large part of the imported metal was destined for the National Stock Pile, but before such disposition this metal overhung and depressed the market; unabsorbed large stocks abroad and world production capacity greatly exceeding present world needs were added depressants.

The high rate of mercury consumption in 1949 is explained in part by new mercury-boiler installations, whereas the record peacetime use in 1948 was accounted for in part by new chlorine and caustic soda constructions. The mercury in such plants is not "consumed" in a strict sense, because it can be reclaimed and reused if the plant is dismantled. Other than the new boiler plants, which required less new metal than the chlorine and caustic soda installations in 1948, noteworthy consumption gains were made only for electrical purposes (including the new cell) and for antifouling paint.

In the first half of 1949 production was at an annual rate lower than at any time since 1850, when production records began. The reopening of the Cordero mine, Humboldt County, Nev., and its substantial output in the latter part of the year raised the domestic total well above expectations for the year. This property and the Mount Jackson mine, Sonoma County, Calif., were the only large properties in production at the year end. The Bonanza mine, Douglas County, Oreg., second-largest in the early months of 1949, closed November 30, and the closure was said to be permanent. The Cordero mine closed February 15, 1950, only two watchmen remaining at the property.

Of the record receipts of metal in 1949, 94 percent was from Europe; Italy supplied 82 percent, Spain 9 percent, and Yugoslavia 3 percent. Most of the material entered, as already stated, was for the Government stock pile; it was metal acquired in Italy by the Economic Cooperation Administration with counterpart funds[1] accumulated there and earmarked for the purchase of strategic materials. United States exports of mercury were small, as usual, amounting to less than 1 percent of imports.

[1] Recipients of goods and services from ECA grants pay for them in local currency into their respective Government's counterpart fund. The fund is used by each Government to improve its country's economy, except that 5 percent is allocated to the United States.

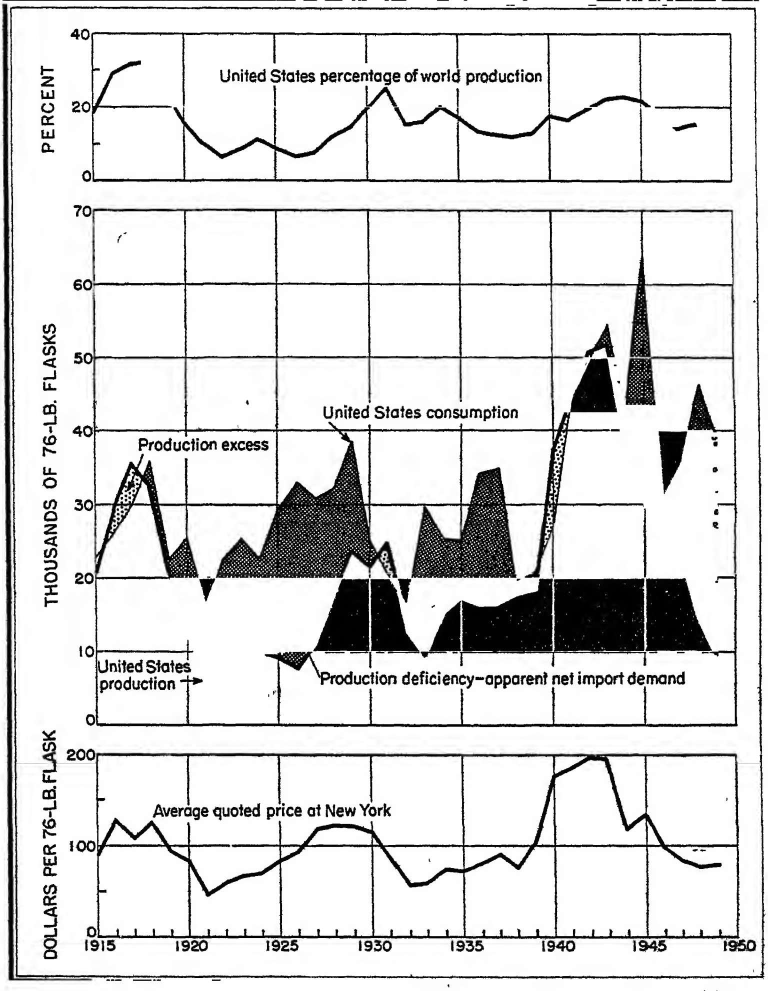

FIGURE 1.—Trends in production, consumption, and price of mercury, 1915–49.

Salient statistics of the mercury industry in the United States, 1940–44 (average) and 1945–49

[Flasks of 76 pounds]

	1940–44 (average)	1945	1946	1947	1948	1949
Production	44,632	30,763	25,348	23,244	14,388	9,930
Number of producing mines	158	68	51	37	20	23
Average price per flask: New York	$174.36	$134.89	$98.24	$83.74	$76.49	$79.46
Imports for consumption	22,842	68,617	13,894	13,008	31,951	103,141
Exports	2,737	1,038	907	884	[1] 526	577
Consumption	43,740	62,429	31,552	35,581	46,253	39,857

[1] Revised figure.

The movement of prices reflected the depressed condition of the domestic industry. Late in December 1948 Mercurio Europeo, the Spanish-Italian cartel, marked up its price for mercury $14 a flask, reversing the downtrend generally in progress from March 1945. The downtrend was resumed almost immediately, the price falling from $89.60 a flask at New York in January to $71 in December. The average for 1949 ($79.46 a flask) was slightly above that for 1948 but otherwise was the lowest annual average since 1938. Since 1938 the Bureau of Labor Statistics index for all commodities, including many items affecting cost of producing mercury, has more than doubled, so that the 1949 price probably represents less than $40 in prewar purchasing power.

Mercurio Europeo was reported to have dissolved January 1, 1950, Italy's disproportionate shipments to the United States in 1949 being rumored as the cause.

The 1948 report of this series contains a historical table on domestic and world production, and United States imports, exports, consumption, and prices for 1910–48.

Strategic Minerals Investigations.—The Bureau of Mines was authorized by the Strategic Materials Act of 1939 to investigate deposits of seven strategic minerals, including mercury, with the objective of developing tonnages of low-grade material that could be mined in an emergency. The program was expanded during the war to include other minerals and the objective became the more immediate one of expanding production. A report [2] recently published described results of the program for 1939–49. For mercury it said:

> Most of the mercury projects undertaken indicated at least low-grade ore. The contained mercury is more than double that used during a year at the peak of wartime consumption. Eight of the deposits produced during the war. One of them was the second largest domestic producer for several years. At another project, the operator followed up the Bureau indications with additional development that showed 300,000 tons of 20-pound ore, which is in itself equivalent to more than the peak wartime year's consumption.
>
> The post-war decline in price has stopped most domestic production, but the unmined tonnages indicated by the Bureau's work would be available during another period of high prices such as might prevail during a war.

Tonnages of mercury ore from 332 examinations at 43 deposits were reported as follows:

> 370,000 tons of high-grade ore, averaging 16.2 pounds mercury per ton, developed.
>
> 1,220,000 tons of low-grade, averaging 2.5 pounds mercury per ton, developed.
>
> 285,000 tons of 1.6-pound material indicated by dump sampling.

The Bureau of Mines recently published a report [3] on concentration tests on mercury ores. Ores tested included three from Jackson County, Oreg., and one each from Valley County, Idaho; Storey County, Nev.; and Sonoma County, Calif. In summarizing, the report stated:

> In general, the ores from Oregon were not amenable to concentration by flotation because of intimate association of cinnabar with other minerals or because of extremely low grade. One Oregon ore was amenable to direct distillation provided lime was added to reduce corrosion of the retort.
>
> The sample from Idaho was composed of a sticky gouge material that had never been treated effectively. Laboratory tests showed that the ore could be dis-

[2] Moon, Lowell B., Strategic Minerals Development Program, Summary of Progress, 1939–49: Bureau of Mines Rept. of Investigations 4647, 1950, 62 pp.

[3] Wells, R. R., Laboratory Concentration of Mercury Ores from Oregon, California, Idaho, and Nevada: Bureau of Mines Rept. of Investigations 4620, 1950, 19 pp.

integrated, deslimed, and the sand fractions treated by direct furnacing. The ore also proved to be amenable to flotation.

The low-grade ore from Nevada was readily concentrated by flotation or combined tabling and flotation.

The California ore could be partly concentrated by sizing and was fairly amenable to concentration by flotation.

DOMESTIC PRODUCTION

During most of 1949 only two important mercury-producing mines were in operation. At the beginning of the year they were the Mount Jackson (including Great Eastern), Sonoma County, Calif., and the Bonanza, Douglas County, Oreg., and at the end of the year they were the former and the Cordero mine, Humboldt County, Nev. The idle Cordero mine was reopened and produced in the latter part of the year; but the Bonanza closed November 30, and the closure was said to be permanent. The maintenance of a nucleus of a domestic mining industry has been surprising in view of reported domestic mining costs of production and repeated threats, over many months, of an impending complete shut-down of domestic mines. There seems to be little doubt that a part, perhaps substantial, of domestic production in 1949 was uneconomic. The evidence is that output in 1950 will continue the decline in progress since 1943.

A total of 9,930 flasks of mercury was produced in 1949, 31 percent below 1948 and the smallest annual total since 1933. In only 7 years in the past 100 has production been smaller than in 1949. In the early months of 1949 output was at an annual rate lower than at any other time since production records began in 1850.

Mines that produced over 50 flasks each were as follows:

Alaska—Decoursey Mountain mine.

California—San Benito County, Juniper, New Idria, and North Star mines; Sonoma County, Mount Jackson (including Great Eastern) mine.

Nevada—Humboldt County, Cordero mine.

Oregon—Douglas County, Bonanza mine.

These 7 mines accounted for 98 percent of the United States total in 1949; in 1948, 10 mines produced 98 percent but in 1942 it took 34 mines to furnish 89 percent.

Mercury produced in the United States, 1946–49, by States

Year and State	Producing mines	Flasks of 76 pounds	Value[1]	Year and State	Producing mines	Flasks of 76 pounds	Value[1]
1946:				1948:			
Alaska	2	699	$68,670	Alaska	1	100	$7,649
Arizona	1	95	9,333	California	13	11,188	855,770
Arkansas	2	11	1,081	Idaho	1	543	41,534
California	32	17,782	1,746,904	Nevada	4	1,206	92,247
Idaho	1	868	85,272	Oregon	1	1,351	103,338
Nevada	7	4,567	448,662				
Oregon	6	1,326	130,266	Total	20	14,388	1,100,538
Total	51	25,348	2,490,188	1949:			
				Alaska	1	100	7,946
1947:				California	15	4,493	357,014
Alaska	1	127	10,635	Nevada	5	4,150	331,348
California	26	17,165	1,437,397	Oregon	2	1,167	92,730
Idaho	1	886	74,194				
Nevada	6	3,881	324,995	Total	23	9,930	789,038
Oregon	3	1,185	99,232				
Total	37	23,244	1,946,453				

[1] Value calculated at average price at New York.

Mercury produced in the United States, 1942–45, by months, and 1946–49, by quarters, in flasks of 76 pounds

Month	1942	1943	1944	1945	1946	1947	1948	1949
January	3,700	4,200	4,400	2,500	5,550	6,100	5,300	1,440
February	3,400	3,900	3,800	2,700				
March	4,100	4,600	3,800	3,000				
April	4,200	4,600	3,700	3,000	7,000	5,700	3,600	1,460
May	4,800	4,200	3,400	3,300				
June	4,900	4,100	3,000	3,000				
July	4,700	4,300	2,700	3,600	6,500	5,850	3,150	6,980
August	4,500	4,500	2,500	3,300				
September	4,200	4,500	2,500	2,050				
October	4,100	5,200	2,700	1,200	6,150	5,550	2,050	
November	4,100	5,000	2,300	1,350				
December	4,400	4,200	2,500	1,600				
Total: Preliminary	51,100	53,300	37,300	30,600	25,200	23,200	14,100	9,880
Final	50,846	51,929	37,688	30,763	25,348	23,244	14,388	9,930

For many years the trend in grade of mercury ore treated in the United States was downward. This trend was reversed notably in 1944, and since then the average has been higher than for many prior years. In 1949 the average differed little from that in 1948 but was 15 percent or more below the best recent years, 1946 and 1947.

Mercury ore treated and mercury produced therefrom in the United States, 1927–49 [1]

[That material from old dumps which is not separable is included with ore]

Year	Ore treated (short tons)	Mercury produced: Flasks of 76 pounds	Mercury produced: Pounds per ton of ore	Year	Ore treated (short tons)	Mercury produced: Flasks of 76 pounds	Mercury produced: Pounds per ton of ore
1927	99,969	10,711	8.1	1939	191,892	18,505	7.3
1928	142,131	14,841	7.9	1940	449,940	37,264	6.3
1929	248,314	19,461	6.0	1941	652,141	43,873	5.1
1930	288,503	18,719	4.9	1942	733,360	49,066	5.1
1931	260,471	22,625	6.6	1943	613,111	50,761	6.3
1932	108,118	11,770	8.3	1944	300,385	37,333	9.4
1933	78,089	8,381	8.2	1945	209,009	29,754	10.8
1934	126,931	13,778	8.2	1946	157,469	24,929	12.0
1935	135,100	15,280	8.6	1947	139,311	22,823	12.5
1936	141,962	14,007	7.5	1948	103,220	13,891	10.2
1937	186,578	16,316	6.6	1949	71,977	9,745	10.3
1938	199,954	17,816	6.8				

[1] Excludes mercury produced from placer operations and from clean-up activity at furnaces and other plants.

In addition to the mercury produced at the mines in 1949, at least 1,385 flasks were reported as produced from battery plates, scrap, and calomel, compared with 2,170 flasks in 1948. Additional unreported quantities doubtless were recovered.

REVIEW BY STATES

Alaska.—Underground activity at the Decoursey Mountain mine was stopped in August 1948, but placer operations yielded some mercury in 1949. The property is equipped with a jaw crusher and two D retorts.

California.—Fifteen mines produced some mercury in California in 1949, and one of the three leading producers in the United States—

the Mount Jackson (including Great Eastern)—is located in the State, in Sonoma County. For the first time in many years California's output was less than half of the United States total; output in 1949 was 45 percent contrasted with 78 and 74 percent in 1948 and 1947, respectively. Counties other than Sonoma that yielded some mercury in 1949 were Fresno, Napa, San Benito, San Luis Obispo, and Santa Clara.

A Gould rotary furnace was installed at the Archer mine, Fresno County, and after being operated experimentally for 2 weeks was closed on December 5. In all, 300 tons of ore was processed to recover 7 flasks of mercury. The mine was closed because the market did not permit economic production.

Bureau of Mines work at the Abbott mine, Lake County, was described [4] in a report published recently. According to the report, the mine was discovered in 1862 and since first production in 1870 to 1946, inclusive, produced about 37,480 flasks, of which 30,880 were recovered through 1940 and 6,600 from 1941 to 1946, inclusive. The mine has not produced since August 1946.

A few flasks of mercury were produced from Oat Hill dumps in Napa County in 1949. A Bureau of Mines report on the Oat Hill mine was issued in October.[5] The mine was discovered in 1872. Total production from 1876 to 1944, inclusive, was said to have exceeded 164,000 flasks. There has been no production since 1945.

Berg and Sciochetti produced mercury in retorts at the Juniper mine, San Benito County. The New Idria mine, which when active is usually the largest producer in the United States, was not operated in 1949, except for making occasional runs on ore removed in maintenance and retimbering work. Ore taken from the North Star mine by Leonard W. Knepper was furnaced at New Idria. R. Diaz produced a small quantity of mercury in a retort at the Aurora mine. The rotary furnace at the property was inactive.

The property of the New Idria Quicksilver Mining Co. property at Idria, Calif., was explored for additional ore bodies by the Bureau of Mines in cooperation with the Geological Survey, and a report on the results was released in August.[6] According to the report, the New Idria operation produced 460,820 flasks of mercury from 1858 to 1947—378,459 through 1935 and 82,361 thereafter.

Raymond Dodd produced a little mercury in a retort from clean-up operations around an old furnace at the Klau mine, San Luis Obispo County.

Kirk & Stotesberry mined 35 tons of ore by open-cutting a reportedly new outcrop at the Almaden mine, Santa Clara County. Satisfactory operation of a "new-type" retort, in which 29 flasks of metal were recovered, was reported. Plant clean-up operations at the Guadalupe mine yielded a little mercury. Activity on Almaden dumps again resulted in some production.

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[4] Wiebelt, Frank J., Investigation of the Abbott Quicksilver Mine, Lake County, Calif.: Bureau of Mines Rept. of Investigations 4558, 1949, 11 pp.

[5] Johnson, Fremont T. and Ricker, Spangler, Investigation of Oat Hill Mercury Mine, Napa County, Calif.: Bureau of Mines Rept. of Investigations 4542, 1949, 23 pp.

[6] Trengove, Russell R., Investigation of New Idria Mercury Deposit, San Benito County, Calif.: Bureau of Mines Rept. of Investigations 4525, 1949, 24 pp.

The Mount Jackson (including Great Eastern) mine was one of the two largest mercury-producing mines in the United States in 1949. Of the three leading mines, this was the only one to operate continuously. Ore is treated in a Gould rotary furnace.

C. A. Baumeister & Son produced 13 flasks from furnacing 70 tons of ore at the Culver-Baer mine and Frank A. Dewey 20 flasks from furnacing 120 tons at the Dewey-Geyser mine.

Nevada.—Virtually all of the mercury output in Nevada in 1949 was from the Cordero mine, Humboldt County, which was productive in the latter part of the year only, but which ranked as the leading producer in the United States nonetheless. Other than Cordero, the only properties for which production was reported were the Red Rock mine, Esmeralda County; a mine at Ione, Nye County; and the Red Bird mine and another property, Pershing County. Ore is treated at Cordero in an 80-ton Nichols-Herreshoff furnace.

Oregon.—Only two properties reported production in 1949, by far the more important of which was the Bonanza mine, Douglas County. This mine was the third-largest mercury producer in the United States in 1949 and had been the leading producer in Oregon for 12 years. The company reported that mine and plant (Gould rotary) were closed November 30, and the shut-down was said to be permanent.

CONSUMPTION AND USES

The installation of three new mercury-boiler plants featured consumption of mercury in 1949. The disappearance of mercury from stocks for plants such as these is not actually consumption, because the metal can be almost entirely reclaimed and reused if the plant is dismantled. The Bureau of Mines excludes as consumption reuse of such metal. One of the new plants that went into operation in 1949—the Pittsfield, Mass., plant, for example—used mercury released by the closing of a larger unit at Schenectady, N. Y. The mercury used at Pittsfield is therefore not included in the consumption figures given here. The other new boiler installations were a replacement plant at Hartford, Conn., representing consumption only insofar as new metal was used to supplement mercury from the old, smaller unit, and a new plant at Portsmouth, N. H. Boiler plants did not take as much new mercury in 1949 as the new chlorine and caustic soda installations did in 1948.

Consumption of mercury in the manufacture of antifouling paint made the most noteworthy gain in 1949, rising 69 percent over 1948, and electrical apparatus (including the new cell) increased 13 percent. After 2 years in which the use of mercury for agricultural products considerably more than doubled, consumption for this purpose dropped 34 percent in 1949. Industrial and control instruments declined 11 percent. Manufacture of fulminate took only 34 percent as much as in 1948.

Mercury consumed in the United States, 1948–49, in flasks of 76 pounds

Use	1948	1949	Use	1948	1949
Pharmaceuticals	3,382	3,443	Electrical apparatus	[1] 6,471	[1] 7,323
Dental preparations	[1] 994	[1] 963	Industrial and control instruments	[1] 5,653	[1] 5,916
Fulminate for munitions and blasting caps	441	149	Amalgamation	143	165
Agriculture	7,048	4,667	General laboratory	442	345
Antifouling paint	996	1,683	Redistilled	[1] 6,499	[1] 6,642
Electrolytic preparation of chlorine and caustic soda	806	755	Other	10,116	6,186
Catalysts	3,262	2,520	Total	46,253	39,857

[1] A partial break-down of the "redistilled" classification showed 53 percent was for instruments, 16 percent for dental preparations, and 16 percent for electrical apparatus in 1948 and 51, 15, and 17 percent, respectively, in 1949.

Mercury consumed in the United States, 1942–45, by months, and 1946–49, by quarters, in flasks of 76 pounds

Month	1942	1943	1944	1945	1946	1947	1948	1949
January	3,800	4,500	3,400	5,200				
February	3,000	4,700	3,700	5,100	6,800	9,000	10,000	10,400
March	3,500	4,900	3,600	6,100				
April	3,600	5,500	3,200	7,500				
May	4,200	5,600	3,100	8,900	8,100	8,500	15,700	7,600
June	3,700	4,700	3,400	8,500				
July	3,200	4,700	3,000	6,600				
August	3,700	4,900	3,900	5,300	7,400	7,700	9,400	8,000
September	4,100	4,100	3,900	3,100				
October	6,200	3,800	3,900	3,100				
November	6,200	3,900	3,900	2,500	8,900	9,900	10,300	13,900
December	4,500	3,200	3,900	2,000				
Total: Preliminary	49,700	54,500	42,900	63,900	31,200	35,100	45,400	39,900
Final				62,429	31,552	35,581	46,253	39,857

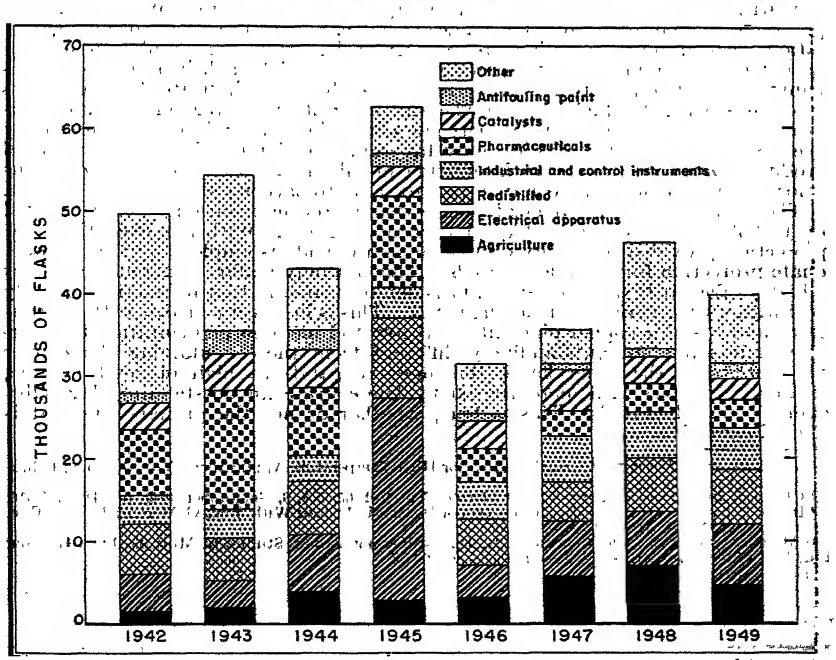

FIGURE 2.—Trends in consumption of mercury by uses, 1942–49.

A new mercury thermal system, claimed to provide simple, dependable, and less expensive means of measurement and control of temperatures above 1,000°, was recently announced.[7]

The De Nora cell for production of caustic soda and chlorine is now licensed by the Monsanto Chemical Co. The cell, developed by the firm of Dott. Ing. Oronzio De Nora, Impianti Electtrochimici, Milan, Italy, was recently described.[8]

Phenyl mercurial compounds for use as fungicides and bactericides in the preservation of textiles were recently discussed.[9] An abstract of the article follows:

> Phenyl mercurials exert strong bactericidal and fungicidal influence even at very low concentrations. Their general use in industry has been retarded by their low solubility and the consequent difficulty of obtaining even applications of sufficient strength on fabrics, and also by the risk of dermatitis involved in handling. These difficulties have been overcome by the production of a phenyl mercuric salt of 2,2′-dinaphthyl merthane-3,3′-disulfonic acid. This salt goes readily into colloidal solution, and the colloid breaks irreversibly when dried on the fiber. Thus it is possible to treat cloth simply and to obtain a fast protection on this cloth. Qualitative and quantitative microbiological tests on cotton and wool are described for this salt (phenyl mercuric Fixtan) and for phenyl mercuric acetate.

In a recent study on antifouling paints, it was stated[10] that compounds of mercury have assumed a minor role in most antifouling paints used by the Navy. The article states:

> Their past history as successful toxics is well-known, and principally for economic reasons have they been forced to assume a secondary role. Mercuric oxide and mercurous chloride have proved to be the most versatile of the inorganic derivatives for adaptation to paint films. To understand more fully the extent to which these toxics may be diluted with inert pigments, the same dilutions already described for copper and cuprous oxide were prepared and exposed. * * *
>
> These data demonstrate the feasibility of utilizing inert pigments in conjunction with inorganic derivatives of mercury. Here again, zinc oxide displays a pronounced superiority over diatomaceous silica and bentonite at lower pigmentations in combination with mercurous chloride. However, similar differences do not hold so obviously for mercuric oxide with which each inert pigment contributes almost equally to general performance. The data indicate that mercurous chloride is a highly efficient toxic when included at higher pigment volume, performing well when diluted with inert pigment. At greater dilution its efficiency decreases, but it still remains in a most favorable position relative to the undiluted product. Zinc dust offers an interesting possibility as a diluent for mercurous chloride, with considerable advantage over diatomaceous silica and bentonite.
>
> The data * * * further indicate that mercuric oxide may be supplanted up to 66% by almost any of the inerts investigated. With few exceptions the protection provided by highly diluted mercuric oxide is ample to guarantee adequate protection for extended periods. This not only reaffirms mercuric oxide as a highly efficient toxic, but versatility is demonstrated in that it functions equally well with a wide variety of inert pigments. This is in direct contrast with cuprous oxide and metallic copper pigments. At low and medium pigmentation the mercury paints are not outstandingly different from those containing the copper pigments. On the other hand, the mercury paints at high pigment volume, particularly those with mercuric oxide, demonstrate an outstanding durability over prolonged periods. This is true, whether or not the primary pigment is diluted extensively.

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[7] Metal Progress, Mercury Thermal System for High-Temperature Applications: Vol. 57, No. 2, February 1950, p. 232.

[8] Chemical Industries, Mercury-Type Chlorine Cell: Vol. 65, No. 3, September 1949, pp. 414 and 416.

[9] Hopp, Peter P., and Race, Edw., Protection of Mechanical Cloth With Phenyl Mercurials: Ind. Eng. Chem., vol. 41, No. 4, April 1949, pp. 820–827.

[10] Alexander, Allen L., and Benemelis, R. L., Antifouling Paints, Studies in Multiple Pigmentation: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1532–1535.

STOCKS

Industry inventories dropped substantially in 1949. Stocks were above normal at the beginning of the year in preparation for the new boiler installations, discussed under Consumption and Uses. Completion of the boiler schedule brought about the stock decline noted. Data on mercury held in the National Stock Pile are confidential; consequently, such stocks are not represented in the accompanying table. The National Stock Pile rose sharply in 1949 owing to receipts of metal obtained through the Economic Cooperation Administration; those purchases were discussed in the General Summary of this chapter.

Stocks of mercury in hands of producers, consumers and dealers, and Office of Metals Reserve, 1945–49, in flasks of 76 pounds

End of year	Producers [1]	Consumers and dealers	Office of Metals Reserve	Total
1945	3,243	17,000	63,638	83,900
1946	2,599	16,400	20,884	39,900
1947	3,084	16,200		19,284
1948	5,165	25,000		30,165
1949	5,354	15,600		20,954

[1] Operators that account for roughly 95 percent of output.

PRICES

The price for mercury generally was downtrending from May 1945 until a gradual strengthening took place in the latter part of 1948 culminating in the rise of $14 in the cartel (Mercurio Europeo) price late in December. The downtrend was resumed almost immediately after the price mark-up and continued to fall virtually without interruption to the end of the year. Quotations ranged from $90 to $93 a flask early in January to $71 to $73 a flask throughout December. The average for all of 1949 was 4 percent above 1948 and was close to the annual average for 1935–38. The Bureau of Labor Statistics index for wholesale prices had more than doubled in the interim, however, so that the 1949 price represented probably less than $40 in prewar purchasing power.

Average monthly prices per flask (76 pounds) of mercury at New York and London, and excess of New York price over London price, 1947–49

Month	1947			1948			1949		
	New York [1]	London [2]	Excess of New York over London	New York [1]	London [2]	Excess of New York over London	New York [1]	London [2]	Excess of New York over London
January	$88.00	$83.61	$4.39	$78.31	$64.49	$13.82	$89.60	$73.57	$16.03
February	86.86	83.57	3.29	76.41	64.50	11.91	88.09	74.08	14.01
March	86.85	83.57	3.28	76.00	64.50	11.50	87.30	74.58	12.72
April	85.77	83.57	2.20	75.46	64.50	10.96	84.65	74.56	10.09
May	84.46	77.81	6.65	74.16	63.69	10.47	82.20	74.56	7.64
June	84.00	69.17	14.83	76.00	60.47	15.53	80.27	74.53	5.74
July	84.00	69.17	14.83	75.42	60.47	14.95	78.16	74.55	3.61
August	84.00	67.28	16.72	75.00	60.47	14.53	74.56	74.53	.03
September	81.64	64.48	17.16	75.04	60.47	14.57	72.80	63.71	9.09
October	80.69	64.50	16.19	76.00	60.47	15.53	73.00	73.66	[3].66
November	79.64	64.49	15.15	77.91	60.47	17.44	71.87	73.52	[3]1.65
December	79.00	64.50	14.50	82.15	63.75	18.40	71.00	73.52	[3]2.52
Average	83.74	73.02	10.72	76.49	62.35	14.14	79.46	73.28	6.18

[1] Engineering and Mining Journal, New York.
[2] Mining Journal (London) prices in terms of pounds sterling are converted to American dollars by using average rates of exchange recorded by Federal Reserve Board.
[3] London excess.

The price in London was £18 5s. in January 1949, moved to £18 10s. in February, and remained at that level until the pound was devalued in mid-September; thereafter it was £26 5s.

FOREIGN TRADE [11]

More mercury was imported into the United States in 1949 than ever before; the total was 50 percent higher than the previous record for 1945 and over 11 times the annual average for 1930–39. As indicated in the General Summary section, most of the metal entered in 1949 was for the National Stock Pile, being mercury purchased by the ECA with counterpart funds accumulated in Italy. Exports regularly are equivalent to only a small fraction of imports; they amounted to less than 1 percent in 1949. Reexports represented close to 1 percent of imports in 1949.

Imports.—Of the 103,141 flasks of mercury imported for consumption in 1949 (comparison with 1948 in parentheses), 84,894 flasks (3,947) came from Italy, 9,264 (19,384) from Spain, 3,176 (1,256) from Yugoslavia, 3,091 (3,489) from Mexico, 2,709 (3,675) from Japan, and over 6 (none) from Canada. In 1935–39, inclusive, Spain furnished 55 percent of United States imports of mercury and Italy 37 percent.

Mercury imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Canada	130,720	$237,175	2	$6	3,801	$2,783
Chile	36,285	55,995	28,064	27,978	20,536	17,504
Honduras	1,748	3,621				
Italy			382,880	325,274	220,352	180,336
Japan					236,161	251,899
Mexico	824,789	1,307,402	407,334	378,235	135,521	103,015
Peru	11,628	19,570				
Spain	4,209,720	7,386,167	237,676	201,783	265,843	201,766
Yugoslavia					106,400	71,400
Total: Pounds	5,214,890	9,009,930	1,055,956	933,276	988,614	828,703
Flasks	68,617		13,894		13,008	

Country	1948		1949	
	Pounds	Value	Pounds	Value
Canada	2	$4	484	$319
Czechoslovakia	15,212	9,920		
Italy	299,983	205,735	6,451,947	5,830,409
Japan	279,326	175,460	205,894	142,772
Mexico	265,140	179,266	234,935	179,206
Spain	1,473,137	931,201	704,074	448,592
Yugoslavia	95,448	65,273	241,371	160,635
Total: Pounds	2,428,248	1,566,859	7,838,705	6,761,933
Flasks	31,951		103,141	

[11] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

General imports are a better measure of goods actually arriving in the country in a given period than are imports for consumption. General imports were 96,918 flasks in 1949 (41,732 in 1948). Of the total 84,628 (4,994) flasks were from Italy, 3,753 (1,691) from Yugoslavia, 3,506 (4,063) from Mexico, 2,777 (3,746) from Japan, 2,225 (27,114) from Spain, and 29 (none) from Canada. In 1948, 75 flasks were received from Sweden and 49 from the United Kingdom.

Imports of mercury compounds generally are insignificant; those of mercuric chloride in 1949 were 25 pounds from the United Kingdom and of mercury preparations not specifically provided for were 44,494 pounds from Sweden.

Exports.—Of the exports of 577 flasks (526—revised—in 1948), 175 (none) went to Denmark, 167 (15) to Korea, 64 (230) to Canada, 32 (28) to Brazil, 25 (31) to Colombia, 24 (17) to Cuba, 18 (81) to Venezuela, and the remainder in quantities of 12 flasks or less to 17 other countries. The reported exports of 259 flasks to Austria in 1948 appears to have been in error.

Reexports totaled 828 flasks (921 in 1948). Of the total, 535 (416) flasks went to Canada, 108 (349) to Brazil, 73 (27) to Colombia, 30 (33) to Belgium and Luxembourg, 27 (45) to Netherlands Antilles, and the remainder in quantities of 19 flasks or less to eight other countries.

Mercury exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Pounds	Flasks of 76 pounds	Value	Year	Pounds	Flasks of 76 pounds	Value
1945	78,877	1,038	$121,713	1948	[1] 40,013	[1] 526	[1] $42,620
1946	68,932	907	113,817	1949	43,860	577	54,413
1947	67,148	884	90,659				

[1] Revised figure.

WORLD REVIEW

The inability, thus far, of world industry to absorb world output of mercury in post-World War II years led to the drop of close to 40 percent in production in 1948, when the smallest world total since 1935 was recorded. The decrease in 1948 was due chiefly to the reduction to less than half in the contribution from Spain, but also to noteworthy declines for Italy, the United States, and Mexico. In 1949 the world total advanced close to 10 percent, according to preliminary figures, the rise being caused largely by an increase in output in Spain; Italy's rise of 5,800 flasks was counterbalanced in large part by the United States drop of 4,500 flasks.

Algeria.—Only a drastic and unexpected change in the price-cost relation for mercury will prevent the shut-down of Algeria's only producer, the Condiat Stah, Ras-el Ma, from being permanent. The company was reported [12] to be planning to dispose of its mining equipment.

[12] Nonferrous Metals, Mercury Production, Algeria: Foreign Commerce Weekly, vol. 37, No. 2, Oct. 10, 1949, p. 32.

World production of mercury, 1941–49, by countries, in flasks of 34.5 kilograms (76 pounds) [1]

[Compiled by Berenice B. Mitchell]

Country [1]	1941	1942	1943	1944	1945	1946	1947	1948	1949
Algeria	147	121	146	165	326	340	346	381	102
Australia:									
New South Wales	1	(2)	—	—	—	—	—	—	—
Queensland	34	15	15	12	3	—	—	—	—
Austria	(3)	(3)	(4)	(4)	(3)	(3)	(3)	(3)	(3)
Bolivia (exports)	—	—	51	2	3	—	—	—	—
Canada	7,057	13,630	22,240	9,682	—	—	—	—	—
Chile	1,305	2,256	2,563	1,181	862	827	445	467	(3)
China	2,756	4,293	3,133	3,510	1,828	1,189	290	290	(3)
Czechoslovakia	(3)	(3)	(3)	(3)	(3)	(3)	[5] 768	800	(3)
Germany	899	493	[6,7] 3,480	[6,7] 3,480	(3)	—	(3)	(3)	(3)
Italy	94,161	75,921	58,004	28,705	25,410	50,822	53,984	38,233	[7] 44,000
Japan [8]	4,323	5,197	6,706	7,096	3,139	1,372	1,622	1,689	2,461
Mexico	23,137	32,443	28,321	26,063	16,443	11,661	9,700	4,786	5,250
New Zealand	73	150	93	90	30	—	—	—	(3)
Peru	—	145	326	152	209	5	—	—	—
Rumania	—	21	176	(3)	(3)	(3)	(3)	(3)	(3)
Southern Rhodesia	2	3	(2)	—	(2)	—	—	—	—
Spain	86,473	72,288	47,756	34,349	40,694	41,801	55,608	22,684	32,289
Sweden	59	11	—	21	1	—	—	—	—
Tunisia	88	3	(2)	—	—	—	—	—	—
Turkey [9]	354	271	186	97	158	—	98	—	—
Union of South Africa	204	579	1,189	1,192	852	764	—	—	—
United States	44,921	50,846	51,929	37,688	30,763	25,348	23,244	14,388	9,930
Total [7]	275,000	265,000	236,000	163,000	131,000	144,000	164,000	102,000	112,000

[1] Mercury is also produced in Korea, Yugoslavia, and U. S. S. R., but production data are not available; estimates by senior author of chapter included in total.
[2] Less than 1 flask.
[3] Data not yet available; estimates by author of chapter included in totals.
[4] Included with Germany.
[5] Byproduct of pyrites production in Slovakia only.
[6] Includes Austria.
[7] Estimate.
[8] Preliminary.
[9] Data revised in some instances to represent production rather than shipments.

Mexico.—Mercury output trended downward from the all-time peak of 32,443 flasks, established in 1942, through 1948; the downtrend was reversed in 1949. Production in Mexico in general is high-cost and cannot compete with the chief world suppliers, Spain and Italy. In 1949 the following companies were said to be producing:

Compania Nacional de Minas, S. A. de C. V., Avenida Madero No. 2, Despacho 503, Mexico, D. F.

Oro, Plata y Mercurio, S. A., Edificio America, Despacho 308, Torreon, Coahuila.

Compania Minera e Industrial de Maconi, S. de R. L. Lopez No. 35, Despacho 201, Mexico, D. F.

Sr. Alejandro Gaitan Cortes, Avenida Matamoros 1407 Pte., Torreon, Coahuila.

Explotadora de Mercurio Huahuaxtla, S. A., Avenida 5 de Mayo No. 18, Mexico, D. F.

Credito Minero y Mercantil, S. A., San Juan de Letran No. 11, Mexico, D. F.

In a report [13] on the Huahuaxtla district, total production since discovery of cinnabar, about 1923, was said to approximate 300,000 kilograms of mercury, or 8,700 flasks, nearly half of which was produced during 1940–44, inclusive. The report states that the many small prospects in the district appear to be of little value and that there is little likelihood of discovering another large deposit in

[13] Gallagher, David, and Silicco, Rafael Perez, Geology of the Huahuaxtla Mercury District, State of Guerrero, Mexico: U. S. Geol. Survey Bull. 960-E, 1948, pp. 149–175.

the district, but that the principal deposit looks promising. Ore reserves data are not significant because little ore is developed ahead of extraction.

Spain.—Dissatisfaction in Spain over the unprecedented shipments of mercury from Italy to the United States in 1949, mentioned in the General Summary section, is reported to have led to the dissolution of the Spanish-Italian mercury cartel, Mercurio Europeo, as of the beginning of 1950. Late in 1949 there were rumors that a large quantity of mercury (possibly 40,000 flasks) had been shipped from Spain, through Switzerland, to the U. S. S. R. or its satellites. The rumors were without official confirmation. Spanish production in recent years has fluctuated widely. Output in 1947 was 55,608 flasks and in 1948 only 22,684; it was 32,289 flasks in 1949.

Mica

By Joseph C. Arundale and E. M. Tucker

GENERAL SUMMARY

DOMESTIC production of sheet mica remained small in 1949, but the United States continued to lead the world in production of ground mica. Imports and consumption of splittings increased, as did the production of built-up mica, which is made from splittings. There was increasing interest in the production of scrap mica, and investigations were being made in several areas of its commercial possibilities.

An article [1] described purchasing procedures of the Colonial Mica Co., including grading, classifying, prices, and forms used.

Salient statistics of the mica industry in the United States, 1945–49

	1945	1946	1947	1948	1949
Domestic mica sold or used by producers:					
Total uncut sheet and punch:					
Pounds	1,298,587	1,078,867	415,589	270,042	513,994
Value	$737,342	$217,955	$116,110	$45,940	$132,097
Average per pound	$0.57	$0.20	$0.28	$0.17	$0.26
Scrap (sales):					
Short tons	41,060	53,602	49,797	52,157	32,856
Value	$812,322	$1,041,423	$1,095,578	$1,091,698	$795,782
Average per ton	$19.78	$19.43	$22.00	$20.93	$24.22
Total sheet and scrap:					
Short tons	41,709	54,141	50,005	52,292	33,113
Value	$1,549,664	$1,259,378	$1,211,688	$1,137,638	$927,879
Total ground:					
Short tons	51,806	62,113	64,540	64,642	56,393
Value	$1,995,969	$2,516,018	$2,967,713	$3,232,632	$2,860,956
Consumption of splittings:					
Pounds	7,897,402	7,815,989	9,309,981	7,917,365	8,114,804
Value	$3,415,696	$4,259,478	$6,680,753	$6,300,581	$7,096,365
Imports for consumption.....short tons	9,411	13,944	11,685	17,896	12,720
Exports.....do	981	1,542	1,493	1,403	1,108

DOMESTIC PRODUCTION

The Bureau of Mines issued reports of investigations of mica deposits in New Hampshire,[2] Connecticut,[3] and the Black Hills of South Dakota.[4] The Federal Geological Survey released in open file two folios containing 28 maps of mica deposits in Idaho and Montana.

Sheet Mica.—Production of 513,994 pounds of sheet and punch mica in the United States in 1949 was only a small percentage of the total

[1] Burgess, Blandford C., Guide for Buying Domestic Muscovite Mica: Mining Trans., Am. Inst. Min. and Met. Eng., vol. 184, December 1949, pp. 453–457.

[2] Levin, S. B., and Mosier, McHenry, Investigation of Big Mica Mine, Cheshire County, N. H.: Bureau of Mines Rept. of Investigations 4410, 1949, 16 pp.

Levin, S. B., and Mosier, McHenry, Investigation of Blister Mica Mine, Cheshire County, N. H.: Bureau of Mines Rept. of Investigations 4409, 1949, 12 pp.

[3] Boos, M. F., Maillot, E. E., and Mosier, McHenry, Investigation of Portland Beryl-Mica District, Middlesex County, Conn.: Bureau of Mines Rept. of Investigations 4425, 1949, 26 pp.

[4] Needham, A. B., Investigation of Mica Deposits at the Victory, Jack Rabbit, Rainbow, and Midas Mines, Custer County, S. Dak.: Bureau of Mines Rept. of Investigations 4507, 1949, 26 pp.

consumed, as it has been for many years. Many small producers of mica failed to report, and the Bureau of Mines again found it necessary to depend largely on reports by purchasers in compiling the statistics on domestic production. The high cost of extracting and processing sheet mica leaves the domestic producer in a poor competitive position in relation to foreign sources.

Scrap Mica.—Sales of domestic scrap mica to grinders in 1949 totaled 32,856 short tons valued at $795,782. This figure includes mine

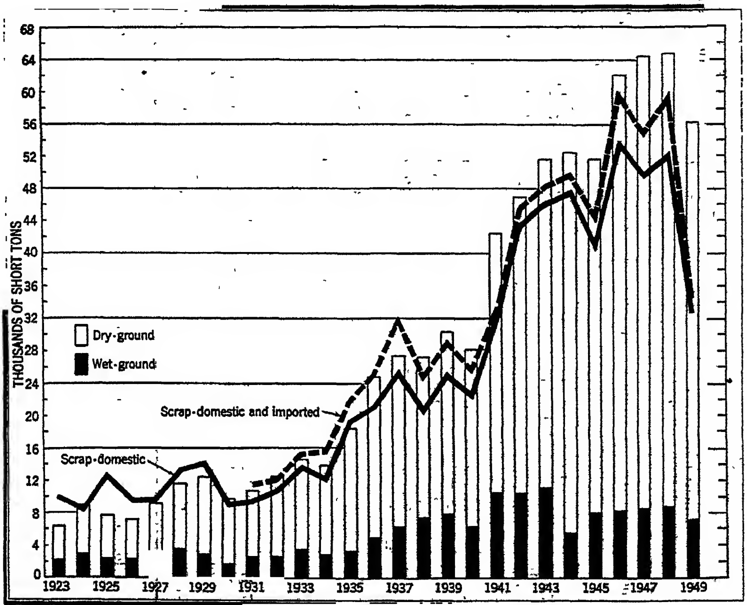

FIGURE 1.—Scrap and ground mica sold in the United States, 1923–49.

scrap, mica reclaimed as a byproduct of kaolin washing, and mica recovered from schist. Together with shop or factory scrap and imported scrap it is the raw material from which ground mica is produced. This figure does not include scrap recovered and used by mica grinders in their own plants.

Scrap and reclaimed mica sold or used by producers in the United States, 1935–39 (average) and 1945–49

	Scrap		Reclaimed [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1935–39 (average)	13,582	$168,688	8,404	$116,824	21,986	$285,512
1945	26,014	487,807	15,046	324,515	41,060	812,322
1946	38,405	750,883	15,197	290,540	53,602	1,041,423
1947	35,199	709,745	14,598	385,833	49,797	1,095,578
1948	(2)	(2)	(2)	(2)	52,157	1,091,698
1949	24,942	526,268	7,914	269,514	32,856	795,782

[1] Mica recovered from kaolin and mica schist.
[2] Bureau of Mines is not at liberty to distribute total because of too few producers of reclaimed.

Mica sold or used by producers in the United States, 1935–39 (average) and 1943–49

Year	Sheet mica						Scrap mica and mica recovered from kaolin and schists		Total	
	Uncut punch and circle mica		Uncut mica larger than punch and circle		Total uncut sheet mica [1]					
	Pounds	Value	Pounds	Value	Pounds	Value	Short tons	Value	Short tons	Value
1935–39 (average)	888,813	$46,408	252,411	$139,306	1,140,724	$185,714	21,986	$285,512	22,557	$471,226
1943	2,691,083	473,955	757,116	2,754,787	3,448,199	3,228,742	46,138	738,025	47,862	3,966,767
1944	835,402	147,635	687,911	3,115,076	1,523,313	3,262,711	51,727	1,089,072	52,489	4,351,783
1945	1,166,858	166,116	131,729	571,226	1,298,587	737,342	41,060	812,322	41,709	1,549,664
1946	986,891	126,039	91,976	91,916	1,078,867	217,955	53,602	1,041,423	54,141	1,259,378
1947:										
North Carolina	169,647	22,601	41,169	61,674	210,816	84,275	38,655	844,086	38,761	928,361
South Dakota	162,380	22,464	26,000	6,240	188,380	28,704	1,499	37,225	1,593	65,929
Other States [2]	11,805	2,034	4,588	1,097	16,393	3,131	9,643	214,267	9,651	217,398
Total	343,832	47,099	71,757	69,011	415,589	116,110	49,797	1,095,578	50,005	1,211,688
1948:										
North Carolina	204,713	22,699	53,213	21,979	257,926	44,678	44,428	992,303	44,557	1,036,981
South Dakota							988	28,515	988	28,515
Other States [2]	12,081	1,229	35	33	12,116	1,262	6,741	70,880	6,747	72,142
Total	216,794	23,928	53,248	22,012	270,042	45,940	52,157	1,091,698	52,292	1,137,638
1949:										
North Carolina	410,630	67,117	59,442	54,153	470,072	121,270	24,801	640,374	25,036	761,644
South Dakota	7,206	846	1,161	2,542	8,367	3,388	1,125	31,285	1,129	34,673
Other States [2]	32,999	4,613	2,556	2,826	35,555	7,439	6,930	124,123	6,948	131,562
Total	450,835	72,576	63,159	59,521	513,994	132,097	32,856	795,782	33,113	927,879

[1] Includes small quantities of splittings in certain years.
[2] Includes Alabama (1947), Arizona (1947 and 1949), California (1947), Colorado (1948–49), Connecticut (1948), Georgia, Maine, New Hampshire (1948–49) New Mexico (1948), Pennsylvania (1949), and Virginia (1947 and 1949).

A report of the investigation of the use of Humphrey spirals in the recovery of flake mica was published.[5]

Co-operative Mines, Inc., started operations at the Star mine northwest of Ojo Caliente, N. Mex. The company has a mill which is expected to produce 50 tons of mica daily from dumps and new development.[6]

The State Research, Planning and Development Board of South Carolina investigated the commercial possibilities of scrap mica in South Carolina,[7] and there was increased interest in mica in Georgia.[8]

Ground Mica.—Sales of 56,393 short tons of ground mica, valued at $2,860,956, represented a moderate decrease from the previous year but were well above the prewar level.

Southeastern Mica Co. of Spruce Pine, N. C., incorporated and erected a grinding plant in the Spruce Pine district.[9] However, this plant did not produce in 1949.

The Wet Ground Mica Association, Inc., 420 Lexington Ave., New York 17, N. Y., issued a bulletin [10] on the properties and uses of wet-ground mica, based on a research program being carried on by that organization.

Ground mica (including mica from kaolin and schist) sold by producers in the United States, 1945–49, by methods of grinding

Year	Dry-ground		Wet-ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	43,686	$1,243,075	8,120	$752,894	51,806	$1,995,969
1946	53,908	1,582,974	8,205	933,044	62,113	2,516,018
1947	55,731	1,852,768	8,809	1,114,945	64,540	2,967,713
1948	55,494	2,035,618	9,148	1,197,014	64,642	3,232,632
1949	49,133	1,850,400	7,260	1,010,556	56,393	2,860,956

CONSUMPTION

Sheet, Punch, and Film Mica.—No accurate statistics on consumption of sheet, punch, and film mica are available. However, incomplete reports indicate that consumption declined in 1949, owing probably to the moderate industrial recession and somewhat wider use of substitute or alternate materials. Certain grades and classes of block and film were acquired for the National Stockpile.

[5] Adair, Ralph, McDaniel, W. T., and Hudspeth, W. R., A New Method for Recovery of Flake Mica from Washing Plant Tailings (Preliminary Report): North Carolina State College of Agriculture and Engineering, University of North Carolina, Rept. of Investigation 1, October 1949, 7 pp. (prep. in cooperation with North Carolina Department of Conservation and Development and Tennessee Valley Authority).
[6] Mining World, vol. 11, No. 4, April 1949, p. 63.
[7] Mining Congress Journal, vol. 35, No. 8, August 1949, p. 55.
[8] Manufacturers Record, vol. 118, No. 12, December 1949, p. 45.
[9] Pit and Quarry, vol. 41, No. 9, March 1949, p. 72.
[10] Wet Ground Mica Association, Tech. Bull. 1, March 1949, 3 pp.

The Mica Fabricators Association issued a booklet [11] discussing the production, fabrication, economics, and uses of mica, with particular emphasis on the characteristics required in the electrical industry.

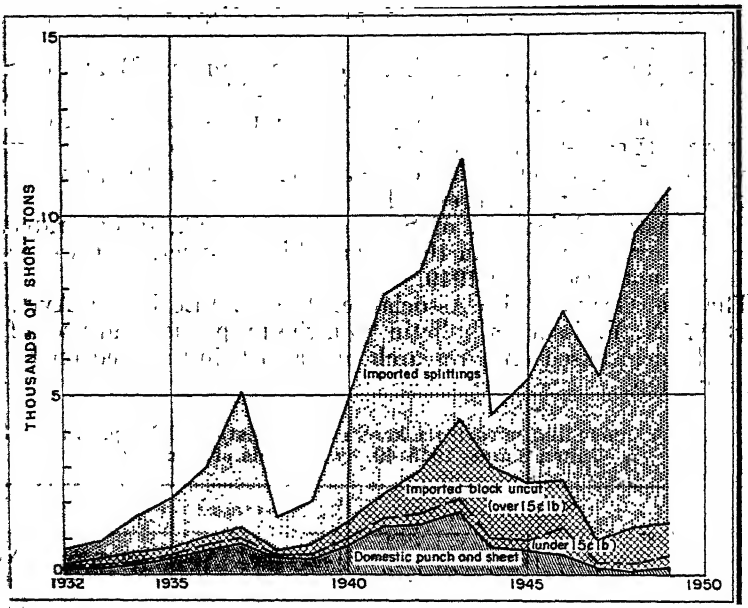

FIGURE 2.—Block mica and splittings imported for consumption in the United States and sales of domestic sheet and punch mica, 1932–49.

Production of sheet and punch mica and apparent consumption of sheet and punch mica and mica splittings in the United States, 1938–49, in pounds

Year	Production	Apparent consumption	Year	Production	Apparent consumption
1938	939,507	3,028,447	1944	1,523,313	15,185,998
1939	813,786	5,147,448	1945	1,298,587	13,310,700
1940	1,625,437	8,893,174	1946	1,078,867	13,282,337
1941	2,466,453	12,840,476	1947	415,589	11,302,644
1942	2,761,844	12,888,273	1948	270,042	11,009,970
1943	3,448,199	17,296,196	1949	513,994	10,999,542

Mica Splittings.—Consumption of mica splittings in the United States during 1949, as reported by consumers, totaled 8,114,804 pounds valued at $7,096,365, a slight increase over the previous year.

[11] Mica Fabricators Association, Handbook on Fabricated Natural Mica: 1949, 15 pp.

Consumption and stocks of mica splittings in the United States, 1945–49, by sources, as reported by consumers

	1945		1946		1947		1948		1949	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Consumption:										
Domestic	94,716	$46,781	7,220	$1,651	81,800	$66,020	[1] 75,395	[1] $33,106	81,001	$45,767
Canadian	321,216	163,658	292,212	152,969	[2] 254,135	[2] 139,504	237,350	150,487		
Indian	7,085,316	2,970,013	7,243,835	3,939,595	8,424,625	6,074,465	7,228,660	5,866,441	7,462,101	6,624,447
Madagascan	324,383	188,530	217,309	130,040	549,421	400,764	375,960	250,547	571,702	426,151
Mexican	71,771	46,764	55,413	35.223	(2)	(2)	(1)	(1)	-----	-----
Total	7,897,402	3,415,696	7,815,989	4,259,478	9,309,981	6,680,753	7,917,365	6,300,581	8,114,804	7,096,365
Stocks in consumers' hands Dec. 31:										
Domestic	7,000	8,430	4,541	1,390	50,700	23,818	147,297	78,992	[3] 85,934	[3] 34,141
Canadian	143,102	91,115	275,685	166,786	[2] 110,162	[2] 64,561				
Indian	2,684,848	1,145,176	5,727,615	3,039,429	5,846,763	4,470,649	3,168,801	2,723,175	3,858,495	4,003,621
Madagascan	193,763	130,661	535,185	378,174	339,220	224,615	402,217	283,170	413,434	365,098
Mexican	35,876	21,235	45,906	29,952	(2)	(2)	-----	-----	(3)	(3)
Total	3,064,589	1,391,617	6,588,932	3,615,731	6,346,845	4,783,643	3,718,315	3,085,337	4,357,863	4,402,860

[1] Mexican included with domestic.
[2] Mexican included with Canadian.
[3] Mexican included with domestic and Canadian.

Built-Up Mica.—Production of 6,295,268 pounds of built-up mica valued at $13,203,854 was a slight increase in quantity over the previous year but below 1946 and 1947.

An article [12] summarized the production and applications of built-up mica insulation.

Built-up mica produced in the United States, 1947–49, by kinds of product

Product	1947		1948		1949	
	Pounds	Value	Pounds	Value	Pounds	Value
Molding plate	1,660,883	$1,832,779	1,545,401	$2,435,709	1,579,846	$2,131,727
Segment plate	1,920,875	2,513,205	2,008,924	3,614,521	1,727,212	3,041,809
Heater plate	1,248,461	2,351,901	1,033,995	2,126,367	1,033,035	1,965,678
Flexible (cold)	677,801	973,247	339,509	575,066	431,660	677,753
All other (tape, etc.)	1,388,094	3,741,913	1,020,989	3,792,278	1,523,515	5,386,887
Total	6,896,114	11,413,045	5,948,818	12,543,941	6,295,268	13,203,854

Ground Mica.—In the first part of 1949 sales of ground mica were slow, due to a moderate decrease in consumption and a tendency of consumers to reduce inventories. Market conditions improved in the latter part of the year. The roofing industry remained the largest consumer, taking 52 percent of the total. The paint industry was the second-largest consumer, and the natural and synthetic rubber industry used the next largest tonnage as an inert filler and dusting agent.

Ground mica (including mica from kaolin and schist) sold by producers in the United States to various industries, 1948–49

Industry	1948			1949		
	Short tons	Percent of total	Value	Short tons	Percent of total	Value
Roofing	[1] 32,969	[1] 51	[1] $1,074,322	29,481	52	$939,587
Wallpaper	1,256	2	148,311	877	2	118,954
Rubber	[1] 4,372	[1] 7	[1] 474,294	3,856	7	378,411
Paint	9,172	14	703,558	8,484	15	620,306
Plastics	590	1	63,428	1,439	2	103,417
Miscellaneous [2]	16,283	25	768,719	12,256	22	700,281
Total	64,642	100	3,232,632	56,393	100	2,860,956

[1] Revised figure.
[2] Includes mica used for molded electric insulation, house insulation, Christmas-tree snow, manufacture of axle greases and oil, annealing, pipeline enamel, oil-well drilling, welding, and other purposes.

PRICES

Prices received for domestic sheet and punch mica vary greatly and generally are determined by direct negotiation between buyer and seller after agreement as to the quality of particular lots. Therefore, the following quotations from E&MJ Metal and Mineral Markets serve only as a general guide and represent a range of prices during 1949: North Carolina district, clear sheet, punch, 12 to 22 cents per pound, according to size and quality; sheet, 1½ by 2 inches, 70 to

[12] South African Mining and Engineering Journal, Production of Micanite: Vol. 60, No. 2966, Dec. 17, 1949, pp. 507-509.

75 cents per pound; 2 by 2 inches, $1.00 to $1.20; 2 by 3 inches, $1.40 to $1.65; 3 by 3 inches, $1.70 to $2.10; 3 by 4 inches, $2.10 to $2.65; 3 by 5 inches, $2.40 to $3.25; 4 by 6 inches, $3.15 to $3.75; 6 by 8 inches, $4.00 to $6.00; stained or electric mica was sold at approximately the same prices as clear sheet.

North Carolina wet-ground mica ranged from $120 to $175 per ton during 1949, depending on fineness and quantity; dry-ground, from $32.50 to $80; scrap, $25 to $35, depending on quality.

South Dakota punch and untrimmed sheet, selected to contain a minimum area of 20 percent sound mica, cut to circle designated: 2-inch, highest quality, 45 cents; average grade, 30 cents; lowest quality, 20 cents; 1 inch, 5 cents to 25 cents, according to grade.

FOREIGN TRADE [13]

Imports.—In 1949 imports of mica of all types totaled 12,720 short tons valued at $19,334,309, compared with 17,896 short tons valued at $15,546,056 in 1948. Most of this decrease was attributed to greatly reduced imports of scrap mica. Imports of muscovite splittings from India, the principal supplier, increased. Imports of muscovite block from Brazil, the leading source of this type, decreased, and deliveries were reported slow. Splittings reported from United Kingdom are Indian splittings, and those reported from Mexico are believed to be largely Brazilian block split in Mexico.

Mica imported into and exported from the United States in 1945–49

Year	Imports for consumption								Exports	
	Uncut sheet and punch		Scrap		Manufactured		Total		All classes	
	Pounds	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	4,208,130	$4,148,737	3,612	$41,950	3,695	$2,173,133	9,411	$6,363,820	981	$377,473
1946	4,499,672	2,288,897	6,207	75,846	5,487	4,754,583	13,944	7,119,326	1,542	709,109
1947	1,754,419	1,150,958	5,109	66,408	5,699	6,251,613	11,685	7,468,979	1,493	970,326
1948	2,829,335	2,477,598	7,124	107,540	9,357	12,960,918	17,896	15,546,056	1,403	720,359
1949	2,460,101	2,082,579	1,758	21,740	9,732	17,229,990	12,720	19,334,309	1,108	676,752

Exports.—The quantity of mica and mica products exported from the United States continued to decrease, although exports of ground mica were only slightly less than in the previous year. There was a marked increase in the number of countries to which unmanufactured mica was shipped.

[13] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Mica imported for consumption in the United States in 1949,[1] by kinds and by countries

[U. S. Department of Commerce]

Country	Unmanufactured									
	Waste and scrap, valued not more than 5 cents per pound				Untrimmed phlogopite mica from which no rectangular piece exceeding in size 1 by 2 inches may be cut		Other			
	Phlogopite		Other				Valued not above 15 cents per pound n. e. s.		Valued above 15 cents per pound	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Angola			74,480	$358					27,564	$63,798
Argentina							409,683	$46,683	209,263	145,491
Brazil			1,992	62			119,734	11,870	953,161	912,298
British East Africa									410	2,924
Canada	542,780	$2,666	38,300	400	28,304	$4,238	98,527	7,005	21,242	26,711
India	438,376	2,992	1,045,919	6,407					415,881	767,193
Mozambique							924	108	2,736	1,558
Peru									200	188
Southern Rhodesia			44,800	321					141,119	70,753
Union of South Africa			1,329,428	8,534					8,949	6,599
United Kingdom									20,199	13,344
Venezuela									2,205	1,818
Total: 1949	981,156	5,658	2,534,919	16,082	28,304	4,238	628,868	65,666	1,802,929	2,012,675
1948	[2]4,834,354	[2]38,046	[2]9,414,366	[2]69,494	434,429	77,167	330,455	35,354	2,064,451	2,365,077

Country	Manufactured—films and splittings							
	Not cut or stamped to dimensions				Cut or stamped to dimensions		Total films and splittings	
	Not above $^{12}/_{10,000}$ of an inch in thickness		Over $^{12}/_{10,000}$ of an inch in thickness					
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Angola	320	$376					320	$376
Argentina					34	$54	34	54
Brazil	22,241	34,060	238,989	$154,794	3,036	4,795	264,266	193,649
Canada	450	450	10	20			460	470
France	42,566	24,980					42,566	24,980
Germany					13	273	13	273
India	17,507,092	15,722,461	205,444	531,016	4,779	31,911	17,717,315	16,285,388
Japan	500	497					500	497
Korea	30,594	8,221					30,594	8,221
Madagascar	730,653	391,557					730,653	391,557
Mexico	8,698	17,156	3,441	15,516	7,257	45,331	19,396	78,003
Pakistan	750	2,092					750	2,092
United Kingdom	28,881	24,153			3,603	72,277	32,484	96,430
Total: 1949	18,372,745	16,226,003	447,884	701,346	18,722	154,641	18,839,351	17,081,990
1948	16,148,048	12,231,738	367,052	417,931	28,905	63,220	16,544,005	12,712,889

See footnotes at end of table.

Mica imported for consumption in the United States in 1949,[1] by kinds and by countries—Continued

Country	Manufactured—cut or stamped to dimensions, shape, or form		Manufactured—other: Mica plates and built-up mica		Manufactured—other: All mica manufactures of which mica is the component material of chief value		Manufactured—other: Ground or pulverized	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Angola							1,633	$52
Brazil	58,348	$68,471	2,725	$9,081	5,046	$16,323		
Canada	1,050	1,050	145	654			532,200	16,941
France			110	290				
India	16,258	25,882	100	70				
Mexico	5,885	6,151	593	1,205				
United Kingdom	10	529	329	689	201	612		
Total: 1949	81,551	102,083	4,002	11,989	5,247	16,935	533,833	16,993
1948	162,540	161,917	3,053	2,139	25,698	33,204	1,978,960	50,769

[1] Changes in Minerals Yearbook, 1948, p. 810, should read as follows: Phlogopite—India, 2,633,077 pounds, $16,102; total—4,834,354 pounds, $38,046. Other—India, 7,655,801 pounds, $58,327; total—9,414,366 pounds, $69,494.

[2] Revised figure.

TECHNOLOGY

A fluorine-phlogopite type of mica has been synthesized in a research program involving the National Bureau of Standards, the Federal Bureau of Mines, and the Colorado School of Mines, under the sponsorship and coordination of the Office of Naval Research. However, there remains the problem of orientation of the crystals produced, and the prospects of producing usable crystals at prices competitive with natural mica are speculative at present.

The American Society for Testing Materials, in cooperation with the Mica Fabricators' Association of New York, has established visual photographic color transparencies for the classification of block mica. These standards consist of one 8-by-10-inch original color transparency for each of 10 representative classes and illustrate the maximum, nominal, and minimum imperfections allowed in each case.[14]

New tentative methods of testing glass-bonded mica were accepted by Committee D-9 on Electrical Insulating Materials, American Society for Testing Materials. These methods cover tests required for investigation or examination of this material for use as electrical insulation.[15]

[14] A. S. T. M. Bull. 158, May 1949, pp. 30-31.

[15] A. S. T. M. Bull. 159, July 1949, pp. 21-22.

Mica and manufactures of mica exported from the United States in 1949, by countries of destination

[U. S. Department of Commerce]

Country of destination	Unmanufactured		Manufactured			
			Ground or pulverized		Other	
	Pounds	Value	Pounds	Value	Pounds	Value
North America:						
Canada	77,039	$9,250	981,645	$41,917	93,327	$290,943
Cuba	224	197	4,510	836	2,682	8,160
Mexico	10,890	5,129	47,500	3,028	10,469	25,943
Netherlands Antilles	1,368	1,263			288	1,457
Other North America					2,001	5,037
South America:						
Argentina			45,000	1,975		
Brazil	3,049	3,273	102,750	5,084	1,820	7,725
Chile	20	236	4,495	295	2,005	5,163
Colombia	120	211			1,332	5,746
Peru					973	6,430
Uruguay					174	789
Venezuela			195,000	8,437	574	1,405
Other South America	78	149			221	633
Europe:						
Austria					20,510	48,113
Belgium-Luxembourg	3,457	6,049	171,600	13,816	4,517	29,349
France					8,172	16,366
Germany			129,280	11,412	5,729	13,292
Greece	331	666	2,000	160	700	1,441
Italy			25,000	2,040	495	5,050
Netherlands			41,000	3,157	605	1,535
Norway					237	430
Portugal			4,400	354		
Spain					21	202
Sweden			10,000	651	191	902
United Kingdom	3,550	10,504			132	198
Other Europe					3	326
Asia:						
China	439	1,335			695	1,765
Formosa					6,765	12,588
India	10,000	650	65,000	2,548	5,157	15,149
Indonesia	800	1,240	21,299	1,727	672	1,903
Israel	1,000	2,060			5,148	13,173
Philippines	1,335	765			1,439	3,440
Other Asia			5,000	110	294	1,115
Africa:						
Belgian Congo					360	395
Mozambique	76	163				
Union of South Africa			55,000	3,766	2,350	4,756
Oceania:						
Australia					79	445
New Zealand			11,700	834	20	101
Total: 1949	113,776	43,140	1,922,179	102,147	180,157	531,465
1948	338,768	68,632	2,268,403	124,926	198,063	526,801

WORLD REVIEW

Argentina.—The most important deposits of muscovite mica in Argentina are in the Provinces of Catamarca, Cordoba, San Juan, and San Luis. A detailed study of the physical and mineralogical properties of this mineral was made.[16]

A special export rate of 7.1964 pesos per $1 United States currency was established for mica exports from Argentina under a revised exchange structure. This preferential rate is expected to stimulate the export of Argentine mica, particularly to the United States.[17]

World production of mica by countries,[1] 1943–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1943	1944	1945	1946	1947	1948	1949
North America:							
Canada (sales)	3,651	3,032	3,195	3,955	3,773	3,584	821
Guatemala	5	1	[2] 1	[2] 4	(3)	(3)	(3)
Mexico	104	[4] 111	[4] 409	[4] 81	[4] 231	(3)	(3)
United States (sold or used by producers):							
Block	1,564	691	589	489	189	122	233
Scrap	41,855	46,926	37,249	48,627	45,175	47,316	29,806
South America:							
Argentina	402	594	719	430	(3)	(3)	(3)
Bolivia (exports)	2	2	------	------	------	(3)	(3)
Brazil	905	1,217	1,016	1,639	[4] 857	[4] 987	7,260
Peru	9	113	491	207	2	------	------
Uruguay	------	3	------	6	14	2	2
Europe:							
Austria	(3)	(3)	(3)	36	78	95	253
Italy	415	15	42	52	16	(3)	(3)
Norway (exports)	957	724	564	224	169	241	113
Portugal	1,200	2,505	------	------	3	------	(3)
Rumania	628	(3)	(3)	(3)	(3)	(3)	(3)
Spain	387	239	18	4	12	11	9
Sweden	327	335	126	69	155	64	(3)
Asia:							
Ceylon	2	2	1	(5)	(5)	------	------
India (exports)	10,242	3,670	4,859	10,675	9,788	18,384	[4] 20,000
Korea:							
North	146	405	95	(3)	(3)	(3)	(3)
South		44		------	------	------	------
Africa:							
Angola	1	4	20	31	89	108	57
British East Africa:							
Kenya		(5)	(3)	------	------	(3)	4
Tanganyika	41	[4] 128	[4] 250	[4] 342	[4] 71	[4] 75	99
Uganda		12	6	(5)	------	2	2
Eritrea	------	(3)	------	(3)	3	(3)	(3)
French Morocco	------	------	------	------	------	144	54
Madagascar	343	493	620	468	450	507	959
Mozambique	------	4	2	2	1	1	(3)
Northern Rhodesia	10	16	7	(5)	------	------	3
Southern Rhodesia	54	250	196	335	296	293	303
Union of South Africa	1,274	1,127	1,131	1,785	2,008	1,362	1,066
Oceania:							
Australia	88	144	158	229	371	427	733
New Zealand	(5)	(5)	(5)	------	------	------	------
Total (estimate) [1]	65,000	63,000	52,000	70,000	65,000	75,000	63,000

[1] In addition to countries listed, mica is also produced in China, Colombia, Ethiopia, and U. S. S. R., but data on production are not available; no estimates for these countries are included in total.
[2] Imports into United States.
[3] Data not available; estimate by senior author of chapter included in total.
[4] Exports.
[5] Less than 1 ton.
[6] Estimate.

[16] Jarnhein, G. (Physical-Mineralogical Study of Mica): Industria Minera (Buenos Aires), vol. 8, No. 90, 1949, pp. 30–33.
[17] Foreign Commerce Weekly, vol. 37, No. 13, Dec. 26, 1949, p. 29.

Australia.—Mica is produced in the Hart Ranges and Plenty River area, Northern Territory of Australia, and stimulation of production has been undertaken by the Department of Supply and Development. Survey work was begun on mapping the field.[18]

India.—The mica mines of Bihar are to be served electric power by the new powerhouse of the Sindri fertilizer plant. This power plant was expected to be completed by December 1949, with an installed capacity of 80,000 kw.[19]

A committee of the Indian Standards Institute prepared a draft report entitled "Indian Standard Methods for Grading Processed Mica." This proposal describes a standard grading system for unmanufactured processed mica according to size, including methods of trimming and definitions of relevant terms used in the trade. A draft report entitled "Indian Specifications of Processed Mica" also was prepared. This describes standard classifications for all commercial forms of unmanufactured processed mica according to visual qualities and structural imperfections. It is reported that final action on these draft reports will not be taken until after the meeting of the International Committee on Mica Standards, expected to be held in Delhi in January 1950 under the chairmanship of the Indian Standards Institution.[20]

Madagascar.—On October 29, 1949, the "Journal Officiel de Madagascar et Dependances" published an order, dated October 24, of the High Commissioner, removing the official f. o. b. prices set for mica exported from Madagascar. Effective November 1, 1949, mica may be sold to France and foreign countries at prices free of control. However, the dollars or other foreign currency must continue to be delivered to the Government. If the export price should appear abnormally low, the Service of Mines may set a different value for computing the mining tax on the mica exported.[21]

Tanganyika.—A small plant was erected by Kunge Mica Mines to treat 3,000 tons of scrap mica at the company property on the east side of Lake Tanganyika. This company is reported to have produced about 30 tons of block mica annually during the war.[22]

Union of South Africa.—Production of mica in the Transvaal decreased in 1949 due to a labor shortage. New deposits were opened up along the Klein Letaba river.[23]

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[18] Chemical Engineering and Mining Review, vol. 42, No. 2, Nov. 10, 1949, p. 46.
[19] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 6, December 1949, pp. 31, 36.
[20] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 6, December 1949, p. 36.
[21] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 5, November 1949, p. 36.
[22] Mining World, vol. 11, No. 4, April 1949, p. 40.
[23] South African Mining and Engineering Journal, vol. 60, No. 2956, Oct. 8, 1949, p. 155.

Molybdenum

By Hubert W. Davis

GENERAL SUMMARY

SUBSTANTIAL declines in the outputs of triple-alloy steel containing nickel, chromium, and molybdenum, chromium-molybdenum alloy steel, and molybdenum-type (6 percent molybdenum and 6 percent tungsten) high-speed steels and a smaller drop in production of molybdenum steel were largely responsible for a 37-percent decrease in shipments of molybdic oxide, calcium molybdate, and ferromolybdenum to domestic consumers in 1949. The smaller demand was also partly the result of unusually large purchases made before the price increase effective January 1, 1949. Exports of molybdic oxide, calcium molybdate, and ferromolybdenum, however, were up 8 percent; production declined 20 percent. Output and shipments of molybdenum metal and ammonium molybdate also declined; but production of sodium molybdate increased substantially, and shipments were virtually the same in both years. As a consequence of the lessened demand for molybdenum products in 1949, the quantity of concentrates converted to oxide was 21 percent smaller than in 1948.

Production and shipments of molybdenum concentrates were 16 and 22 percent, respectively, less in 1949 than in 1948. Colorado retained first place as a molybdenum-producing State; and Arizona, which advanced from fifth to fourth place, was the only State to record an increase in output.

Salient statistics of molybdenum concentrates in the United States, 1945–49, in thousands of pounds of contained molybdenum

	1945	1946	1947	1948	1949
Production	30,802	18,218	27,047	26,706	22,539
Shipments (including exports)	33,683	16,787	22,190	29,669	23,280
Exports [1]	2,863	565	2,989	4,132	5,320
Imports for consumption [2]	204	(3)			48
Consumption	32,696	14,994	20,221	25,156	19,960
Stocks (industry), Dec. 31 [4]	16,883	19,275	23,661	21,206	19,159

[1] Includes roasted concentrates.
[2] Excludes imports for conversion and reexport as follows: 1945, 460,416 pounds; 1946, 276,465 pounds; 1947–49, none.
[3] 10 pounds.
[4] At mines and at plants making molybdenum products.

A small quantity of molybdenum concentrates—the first since 1946—was imported into the United States in 1949.

Industry stocks of molybdenum concentrates were 10 percent less at the end of 1949 than at the close of 1948. However, stocks of molybdenum products held by producers gained 44 percent.

Effective January 1, 1949, the quoted prices of molybdenite concentrate, molybdic oxide, calcium molybdate, and ferromolybdenum were advanced 15 cents a pound of contained molybdenum.

DOMESTIC PRODUCTION

Production of molybdenum concentrates totaled 22,530,000 pounds (contained molybdenum) in 1949, a decrease of 16 percent from 1948. The chief mineral of molybdenum is molybdenite (MoS_2), which comprised virtually the entire output in 1949; powellite [$Ca(Mo,W)O_4$] contributed a relatively small quantity. Wulfenite ($PbMoO_4$), once mined from several deposits in southwestern United States, has not been produced since 1944.

Molybdenum was produced in six States in 1949; Colorado led, followed in order by Utah, New Mexico, Arizona, California, and Nevada. Arizona was the only State to show an increase in 1949. Output of concentrates at mines operated solely or almost solely for molybdenum was 10,960,000 pounds in 1949, a decrease of 18 percent from 1948, whereas byproduct concentrates from copper and tungsten operations totaled 11,570,000 pounds, a drop of 13 percent. Byproduct molybdenum represented 51 percent of the total concentrates produced in 1949 compared with nearly 50 percent in 1948.

Shipments of molybdenum concentrates were 23,280,000 pounds (contained molybdenum) in 1949, a decrease of 22 percent from 1948. The shipments in 1949 comprised 18,993,000 pounds to domestic consumers and 4,287,000 pounds for export.

A historical review of the molybdenum industry in the United States and a table showing its spectacular growth were presented in the chapter of this series in Minerals Yearbook, 1948, pp. 816–819.

Molybdenum in ore and concentrates produced and shipped from mines in the United States, 1940–49

Year	Production (pounds)	Shipped from mines		Year	Production (pounds)	Shipped from mines	
		Pounds [1]	Value [2]			Pounds [1]	Value [2]
1940	34,313,000	25,329,000	$17,189,000	1945	30,802,000	33,683,000	$23,976,000
1941	40,363,000	38,377,000	25,996,000	1946	18,218,000	16,786,600	11,529,000
1942	56,942,000	66,437,000	47,275,000	1947	27,047,000	22,189,800	15,178,000
1943	61,667,000	53,955,000	38,500,000	1948	26,706,000	29,669,000	20,418,000
1944	38,679,000	39,423,000	27,999,000	1949	22,530,000	23,280,000	19,332,000

[1] Figures for 1940–44 represent shipments from mines, plus concentrates converted to oxide by producer at Miami, Ariz.; those for 1945–49 represent shipments to domestic and foreign customers, plus concentrates converted to oxide at Miami, Ariz., and Langeloth, Pa.
[2] Largely estimated by Bureau of Mines.

Arizona.—The Miami Copper Co. was the sole producer of molybdenum in Arizona in 1948 and 1949. Since 1938 the company has been a regular producer of molybdenite, which is recovered as a byproduct of its copper operations at Miami, Ariz. The concentrates are converted to molybdic oxide at Miami; output in 1949 reversed a 2-year downward trend and was 30 percent greater than in 1948. Arizona advanced from fifth to fourth place as a producer of molybdenum in 1949.

Research on the separation of the minute quantity of molybdenite contained in the copper ore at the Morenci mine, Greenlee County, of Phelps Dodge Corp. was about completed in 1949, and production of molybdenite concentrate was begun early in 1950.

California.—California dropped from fourth to fifth place as a producer of molybdenum in 1949. The only producer in California was the United States Vanadium Corp. at Bishop, where the mineral is recovered as a byproduct of tungsten production. The treatment plant of the company was operated at a greatly reduced rate in 1949; as a consequence, recovery of molybdenum was 53 percent less than in 1948. Molybdenum occurs as molybdenite and powellite, which comprised 88 and 12 percent, respectively, of the output in 1949.

Colorado.—Colorado was again the premier molybdenum-producing State. The Climax Molybdenum Co., operating the world-famous deposit at Climax, Colo., was the sole producer of molybdenum concentrates in Colorado in 1949; output was 18 percent smaller than in 1948. Previous to 1948 the Climax deposit had been exploited solely for molybdenum, but in 1948 recovery of tungsten and in 1949 recovery of tin as byproducts were inaugurated. Most of its 1949 output of molybdenite concentrates was shipped to its processing plant at Langeloth, Pa., where the company produces ferromolybdenum, calcium molybdate, molybdic oxide, and other molybdenum products, as well as ferrotungsten.

Nevada.—Since 1941 the Nevada Mines Division of the Kennecott Copper Corp. has been the lone producer of molybdenite concentrates in Nevada. The concentrates are recovered as a byproduct of the McGill concentrator, where copper ores from the company Ruth and Copper Flat operations and from the Emma Nevada group of Consolidated Coppermines Corp. are milled. Output of concentrates was 42 percent less than in 1948 and was the smallest since recovery was inaugurated in 1941.

New Mexico.—The Chino Mines Division of the Kennecott Copper Corp., Hurley, and the Molybdenum Corp. of America, Questa, continued to be the only producers of molybdenite in New Mexico in 1949. The outputs of these producers were 33 and 4 percent, respectively, smaller than in 1948; State output was 27 percent less. At Hurley, molybdenite has been recovered as a byproduct of copper operations since 1937. The Questa mine, which is operated for molybdenum only and is outstanding in richness of the ore, was opened in 1919 and since 1923 has been a regular producer. The concentrates produced at Questa are shipped to the processing plant of the Molybdenum Corp. of America at Washington, Pa., where the company produces ferromolybdenum, calcium molybdate, molybdic oxide, and other molybdenum products.

Utah.—Utah was again the second largest molybdenum-producing State. The sole producer in Utah is the Utah Copper Division of the Kennecott Copper Corp., which since 1936 has been recovering molybdenite as a byproduct of copper at its Arthur and Magna concentrators. Output of molybdenite concentrates in Utah was 10 percent less in 1949 than in 1948.

CONSUMPTION AND USES

Consumption (as measured by shipments to domestic consumers) of molybdenum products in the United States was 37 percent smaller in 1949 than in 1948. The largest single use for molybdenum is as an alloying element in the manufacture of steels, to which it is added as molybdic oxide, calcium molybdate, or ferromolybdenum. In general, when an entire open-hearth heat is to be alloyed to a degree not exceeding 0.8 percent molybdenum, the addition is in the form of molybdic oxide or calcium molybdate; ferromolybdenum is used when higher percentages of molybdenum are desired. Of the total molybdenum used in the United States, it is estimated that about 70 percent is in steels. The addition of molybdenum to conventional 18:8 (18 percent chromium and 8 percent nickel) stainless steel has, it is reported,[1] produced a popular casting alloy with improved corrosion resistance and increased strength at elevated temperatures. Molybdenum is finding an expanding market in the high-temperature alloys developed for various components of gas turbines, as well as in jet aircraft engines and turbosuperchargers. Use of tungsten-molybdenum thermocouples in the study of high-temperature alloys is reported [2] to have resulted in improvement of the range of satisfactory service up to 3,990° F. It is also reported [3] that both the oxidation resistance and strength of molybdenum may be improved by making certain alloying additions and that such alloys can be successfully arc-melted and cast in an argon atmosphere. High-temperature ceramic coatings for molybdenum have been developed.

Much smaller quantities (about 20 percent of the total) of molybdenum, chiefly in the form of ferromolybdenum and molybdic oxide, are employed in gray iron and malleable castings. Molybdenum in various forms finds limited employment in the chemical, electrical, and ceramic industries, which account for about 10 percent of the total. A relatively small quantity of concentrates (50,000 to 75,000 pounds of contained molybdenum annually) is used by a few steel companies as an addition to molten metal in the ladle to raise the sulfur content to improve machinability, in addition to gaining the benefit of the contained molybdenum. Molybdenum is being used with remarkable success as a fertilizer, and it is reported that certain crop yields have doubled as a result of minute additions to the soil.

[1] Mott, N. S., Molybdenum-Bearing Stainless Casting Alloy Has Wide Range of Uses: Materials & Methods, vol. 30, No. 1, July 1949, pp. 50-63.
[2] Potter, R. D., and Grant, N. J., Tungsten-Molybdenum Thermocouples: Iron Age, vol. 163, No. 13, Mar. 31, 1949, pp. 65-69.
[3] Iron Age, Arc Melting Molybdenum-Rich Alloys: Vol. 164, No. 24, Dec. 15, 1949, pp. 82-83.

Production and shipments of molybdenum products[1] in the United States, 1945–49, in pounds of contained molybdenum

Year	Production	Shipments		
		To domestic consumers	Exports[2]	Total
1945	32,406,300	26,977,200	1,327,000	28,304,200
1946	15,039,100	16,501,700	442,400	16,944,100
1947	20,659,700	19,878,500	866,400	20,744,900
1948	24,445,300	23,808,900	1,215,800	25,024,700
1949	19,624,200	15,019,000	1,314,100	16,333,100

[1] Comprises ferromolybdenum, molybdic oxide, and molybdenum salts and metal.
[2] Reported by producers to the Bureau of Mines.

STOCKS

The accompanying table shows industry stocks of molybdenum concentrates and products, 1945–49.

Industry stocks of molybdenum concentrates and products, Dec. 31, 1945–49, in thousands of pounds of contained molybdenum

Year	Concentrates[1]	Products[2]		Total
		Producers	Consumers	
1945	16,883	10,176	2,653	29,712
1946	19,275	8,211	2,582	30,068
1947	23,661	8,126	2,695	34,482
1948	21,206	7,547	(3)	[4] 28,753
1949	19,159	10,838	(3)	[4] 29,997

[1] At mines and at plants making molybdenum products.
[2] Comprises ferromolybdenum, molybdic oxide, molybdenum salts, and metal.
[3] Figure not available.
[4] Excludes stocks of molybdenum products at consumers' plants.

PRICES

Effective January 1, 1949, the published price, f. o. b. mines, of molybdenite in concentrates containing 90 percent MoS_2, was increased to 54 cents a pound of MoS_2 (equivalent to 90 cents a pound of molybdenum contained). The former price of 45 cents a pound of MoS_2 had been in effect since 1938. Molybdenum concentrates are shipped largely to processing plants for conversion to molybdic oxide, the form in which most molybdenum is employed in iron and steel plants. Some oxide, however, is employed in making ferromolybdenum and calcium molybdate, which are also used in the manufacture of iron and steel. The prices of the principal molybdenum products are based on a pound of contained molybdenum, f. o. b. producer's plant. Effective January 1, 1949, the prices of molybdic oxide and calcium molybdate were raised to 95 cents a pound of contained molybdenum and of ferromolybdenum to $1.10; the former prices were 80 and 95 cents, respectively.

FOREIGN TRADE[4]

Imports of molybdenum ore and concentrates into the United States are normally small; 48,148 pounds (contained molybdenum) were received from China in 1949 compared with none in 1948. Some molybdenum ore and concentrates are occasionally imported for conversion to molybdenum products for export; none has been so imported since 1946.

Exports of molybdenum concentrates (including roasted concentrates) were 5,319,780 pounds (contained molybdenum) in 1949 compared with 4,132,341 pounds in 1948. Taking 52 and 29 percent, respectively, the United Kingdom and France were the chief foreign markets in 1949; Sweden and Germany took 10 and 5 percent, respectively.

Exports of ferromolybdenum were 955,103 pounds (gross weight) in 1949 compared with 1,188,949 pounds in 1948, and those of molybdenum metal and alloys were 78,479 pounds compared with 56,303 pounds in 1948.

Tariff.—The duty on molybdenum ore and concentrates continued to be 17½ cents a pound on the metallic molybdenum contained; and on ferromolybdenum, molybdenum metal and powder, calcium molybdate, and other compounds and alloys of molybdenum it was 50 cents a pound of molybdenum contained plus 15 percent ad valorem.

Molybdenum ore and concentrates (including roasted concentrates) exported from the United States, 1947–49, by countries

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Molybdenum content (pounds)	Value	Molybdenum content (pounds)	Value	Molybdenum content (pounds)	Value
Argentina	2,050	$1,808				
Austria	6,589	5,502	10,000	$4,968	5,334	$7,952
Canada	101,650	81,320	159,230	104,336	62,289	50,332
Czechoslovakia	21,820	15,422				
France	555,840	418,509	1,591,210	1,161,353	1,525,564	1,283,495
Germany			131,060	74,945	267,285	246,731
Italy	392,378	294,433	63,201	48,945	64,906	61,262
Mexico					5,370	3,250
Netherlands			13,384	10,567	14,700	13,680
Norway					60,000	56,419
Sweden	105,915	84,895	262,570	195,721	545,761	459,279
United Kingdom	1,803,009	1,330,296	1,901,686	1,397,898	2,768,571	2,441,723
Total	2,989,251	2,232,185	4,132,341	2,998,733	5,319,780	4,624,123

[4] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

WORLD REVIEW

Despite the fact that molybdenum is produced in many parts of the world, the combined output of all countries other than the United States is less than 15 percent of the world total, and most of that comes from a few countries.

World production of molybdenum in ores and concentrates, by countries, 1940–49, in metric tons [1]

[Compiled by Berenice B. Mitchell]

Country [1]	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
Australia	20	24	7	15	9	(2)	4	2	2	3
Austria	--------	--------	4	5	7	(2)	20	(3)	(3)	(3)
Canada	5	47	43	178	509	228	184	207	83	--------
Chile	267	229	580	680	1,051	841	560	402	532	558
China:										
Manchuria	(3)	[4] 75	[4] 384	[4] 516	[4] 516	[4] 30	(3)	(3)	(3)	(3)
Other Provinces	[5] 7	[5] 5	[5] 3	(3)	(2)	(3)	(3)	(3)	(3)	(3)
Finland	47	148	126	108	110	92	99	70	--------	--------
France	--------	--------	2	11	7	--------	(3)	(3)	(3)	(3)
Indochina, French	--------	--------	2	2	(2)	(2)	(3)	(3)	--------	(3)
Italy	21	26	17	9	(2)	--------	(3)	(3)	(3)	(3)
Japan	[6] 13	[6] 41	[6] 56	[6] 87	[6] 189	[6] 108	52	18	1	(3)
Korea, South	83	122	217	291	394	54	--------	5	2	11
Mexico	310	522	855	1,138	717	468	818	136	--------	--------
Morocco, French	35	31	6	7	--------	--------	39	32	--------	(3)
Norway	287	229	368	227	248	76	10	98	79	70
Peru	166	146	154	85	62	29	4	3	3	2
Sweden	--------	--------	--------	12	20	3	--------	--------	(3)	(3)
United States	15,564	18,309	25,829	27,972	17,545	13,972	8,264	12,268	12,114	10,219
Total (estimate)	17,200	20,300	29,000	31,400	21,400	15,900	10,800	14,000	13,600	11,500

[1] Molybdenum is also produced in Greece, Rumania, Turkey, U. S. S. R., and Yugoslavia, but production data are not available. Estimates by author of chapter are included in total.
[2] Less than 1 ton.
[3] Data not yet available; estimate by author of chapter included in total.
[4] Exports to Japan proper.
[5] Data represent areas designated as Free China during the period of Japanese occupation.
[6] Preliminary data for fiscal year ended Mar. 31 of year following that stated.

Canada.—According to the Dominion Bureau of Statistics, there was no production of molybdenite in Canada in 1949 compared with 291,150 pounds in 1948, presumably from the La Corne mine in Quebec.

Chile.—Since 1939, Chile has been a regular producer of molybdenite concentrate; and since output was discontinued by the Greene Cananea Copper Co. in Mexico, it has been the largest producing foreign country. Output of molybdenite in Chile was 930 metric tons in 1949 compared with 887 tons in 1948.

Sweden.[5]—Molybdenum deposits have been found in Snavlunda, Orebro Province, Sweden. Mining rights have been acquired by Gullspang Elecktrokemiska AB, Gullspang, a smelting company.

United Kingdom.—Imports of molybdenum concentrates into the United Kingdom were 2,405 long tons during the first 11 months of 1949 compared with 2,287 tons in 1948.

Yugoslavia.—A new molybdenum mine near Maĉkatica, Serbia, will begin operation by 1951.[6]

[5] Foreign Commerce Weekly, vol. 36, No. 12, Sept. 19, 1949, p. 33.
[6] Foreign Commerce Weekly, vol. 37, No. 10, Dec. 5, 1949, p. 35.

Natural Gas

By D. S. Colby, F. S. Lott, and B. E. Oppegard

GENERAL SUMMARY

MARKETED production of natural gas is estimated to have increased about 7 percent to 5,487 billion cubic feet in 1949. The production of gas from oil wells was reduced as a result of decreased production of domestic crude oil. Consumption of natural gas for domestic uses is estimated to have increased 10 percent, compared with 12 percent in 1948, and commercial consumption is estimated to have increased 16 percent, compared with 13 percent in 1948. An over-all increase in industrial consumption of 4 percent is anticipated in 1949. This total is held down by decreases in the quantities consumed at petroleum refineries and at carbon-black plants. Electric

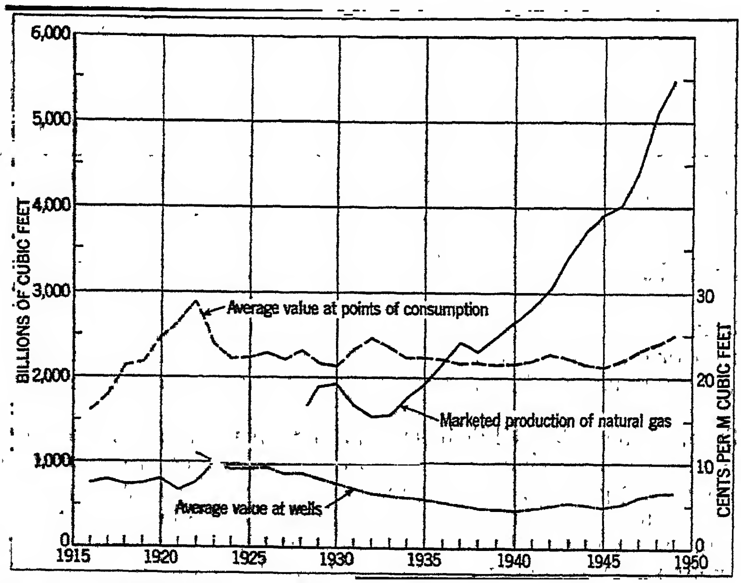

FIGURE 1.—Production and value of natural gas in the United States, 1916–49.

public-utility power plants, however, consumed 15 percent more natural gas than in 1948.

The average value of natural gas at the well remained 6.5 cents per thousand cubic feet in 1949. The average value increased in most States, but reduced production in the high-value States kept the over-all average down. At the point of consumption the average values of natural gas for domestic and commercial purposes are estimated to have increased to 67.5 and 45.0 cents per thousand cubic

feet, respectively. The value of gas for industrial purposes, however, is thought to have declined slightly to 12.3 cents per thousand cubic feet. The total value of natural gas marketed in 1949 on this basis was 1,316 million dollars as compared with 1,194 million in 1948. This gas was used by over 16 million consumers, either as "straight" natural gas or mixed with manufactured gas.

Salient statistics of natural gas in the United States, 1945–49

	1945	1946	1947	1948	1949 [1]
MILLION CUBIC FEET					
Supply:					
Marketed production [2]	3,918,686	4,030,605	4,582,173	5,148,020	5,486,582
Withdrawn from storage	36,167	56,138	86,643	79,035	97,000
Total supply	3,954,853	4,086,743	4,668,816	5,227,055	5,583,582
Disposition:					
Consumption	3,900,479	4,012,930	4,426,544	4,945,149	5,254,082
Exports	18,207	17,675	18,149	18,704	19,500
Stored	61,502	75,458	96,316	136,406	180,000
Lost in transmission, etc.	(3)	(3)	127,807	126,796	130,000
Total disposition	3,980,188	4,106,063	4,668,816	5,227,055	5,583,582
VALUE					
Production (at wells) thousand dollars	191,006	212,251	274,709	333,173	355,472
Average per M cubic feet cents	4.9	5.3	6.0	6.5	6.5

[1] Preliminary figures.
[2] Figures exclude in 1945–46 and include in 1947–49 gas stored and lost in transmission.
[3] Figure not available.

OUTLOOK

The growth and planned expansion of the natural-gas industry continued in 1949 in spite of the mild business recession in the first part of the year. The shortage of steel, which had hampered pipeline construction and appliance manufacture, disappeared almost entirely by the end of 1949. Restrictions on the installation of space-heating equipment were being relaxed as additional supplies of gas became available. Added impetus to conversion of consuming equipment from coal has been given by the uncertainty of coal supplies due to the increasing labor disturbances in the coal fields. This conversion is taking place in electric public utilities as well as in homes and factories. The present advantageous price position of natural gas relative to other fuels probably will continue under the controls of the Federal Power Commission and State public utility commissions.

Several factors in addition to increasing demand and costs tend to raise natural-gas prices. Both Kansas and Oklahoma have instituted minimum wellhead price regulation. Several bills were presented to the Congress which would have limited Federal Power Commission authority to companies conducting interstate business. State legislatures have considered, though not always favorably, bills to increase severance taxes and taxes on the gross revenue of utilities.

The major operating problems of gas-utility companies continue to be how best to utilize natural gas as it becomes available and how to meet peak-load requirements. Storage of natural gas or LP-gases is meeting this latter problem in some regions, while standby manufactured-gas plants provide peak supplies in others. Among the alternatives that can be adopted by distributing companies as new

supplies of natural gas reach their communities are complete conversion to natural gas, use of natural gas for base load supplemented by other gases during high-demand periods, re-forming the natural gas, or the use of natural to enrich manufactured gas.

Authorizations and specific plans for new construction, based upon the favorable position of natural gas with respect to available supplies and competitive fuels, appear to assure continued rapid growth in natural-gas sales for the next several years. Emphasis will be upon service to new consumers in areas far removed from the major sources of supply.

GOVERNMENT REGULATIONS

The authority of the Texas Railroad Commission to shut down an oil field to eliminate flaring of gas was upheld by the Texas Supreme Court.

It has long been suggested that State conservation commissions be given power to set minimum field prices for gas in order to enforce ratable take and protect the correlative rights of individual producers within a field. On February 18, 1949, the Kansas Corporation Commission set a minimum wellhead price for natural gas in the Kansas Hugoton field. The State Supreme Court will rule on the legality of this in 1950. In April 1949 the Oklahoma Senate passed a bill authorizing the State corporation commission to control the minimum price of natural gas within that State. The Oklahoma Corporation Commission had attempted in 1947 to set a minimum price under then existing statutes.

The United States Supreme Court in June 1949 ruled that the Federal Power Commission could not regulate the sale of a natural-gas company's reserves. In a decision of January 9, 1950, it ruled against the East Ohio Gas Co. in upholding the Federal Power Commission's authority over this company, although all of its business and facilities are in Ohio. Bills have been introduced into the United States Congress by Ohio Congressmen in an effort to exclude from the definition of "natural-gas company" any person who receives his supply of gas within or at the border of the State wherein he is engaged in local distribution.

A great deal of confusion has arisen over the extent to which the Federal Power Commission has control over independent producers and distributors of natural gas. A bill introduced in 1949 into the United States Senate provided that Federal Power Commission jurisdiction should not apply to natural-gas exploration, drilling, production or gathering, sale at arms length, sale before arms length sale to interstate facilities, local distribution, and local distribution facilities. This bill was passed by both the United States Senate and the United States House of Representatives in 1950 but was vetoed by President Truman.

RESERVES

The committee on natural-gas reserves of the American Gas Association reported proved reserves of natural gas in the United States to be 180,381,000 million cubic feet as of December 31, 1949. This represents a net increase of 4 percent over 1948. The gross addition to proved reserves in 1949 comprised 8.1 trillion cubic feet in extensions of old fields and 4.6 trillion cubic feet in new fields and pools.

Estimated proved recoverable reserves of natural gas in the United States, 1948–49, in millions of cubic feet [1]

[Committee on natural gas reserves, American Gas Association]

State	Reserves as of Dec. 31, 1948	Changes in reserves during 1949 [2]			
		Extensions and revisions	Discoveries of new fields and new pools in old fields	Net change in underground storage [3]	Net production [4]
Arkansas	901,838	27,739	3,783	15	59,185
California	10,192,593	151,526	187,899	3,105	543,488
Colorado	1,349,179	−102,384	5,128		24,828
Illinois	227,804	29,378	16,140		40,130
Indiana	21,600	5,890	3,960		6,250
Kansas	14,407,832	−8,123	10,855	2,279	323,283
Kentucky	1,378,151	50,381	8,400	2,465	90,000
Louisiana	23,977,520	2,238,587	1,277,430		805,726
Michigan	182,987	39,514	3,683	6,165	17,438
Mississippi	2,504,336	81,499	12,084		68,950
Montana	852,605	−16,646	4,021	1,416	37,925
New Mexico	5,606,361	737,698	146,287	7,363	256,706
New York	67,615	225		2,545	3,700
Ohio	629,453	42,264	9,225	18,629	47,000
Oklahoma	11,332,445	606,335	251,012	3,522	567,335
Pennsylvania	617,410	48,148	8,700	17,422	70,000
Texas	95,708,553	3,963,647	2,521,917		3,023,714
Utah	69,798	1,754	338		6,313
West Virginia	1,737,167	116,372	24,500	17,194	180,000
Wyoming	2,093,740	43,692	107,958	626	72,339
Other States [9]	10,353	3,933	9,550		731
Total	173,869,340	8,061,429	4,612,870	82,746	6,245,041

State	Reserves as of Dec. 31, 1949 [2]				
	Nonassociated [5]	Associated [6]	Dissolved [7]	Underground storage [8]	Total
Arkansas	438,861	161,224	272,645	1,460	874,190
California	2,773,105	2,357,637	4,845,763	15,130	9,991,635
Colorado	580,442	33,603	613,050		1,227,095
Illinois	5,692	15,000	212,500		233,192
Indiana	5,000		20,200		25,200
Kansas	13,702,217	127,988	230,206	29,149	14,089,560
Kentucky	1,270,903		66,000	12,494	1,349,397
Louisiana	20,954,929	4,135,685	1,597,197		26,687,811
Michigan	145,642		47,495	21,774	214,911
Mississippi	1,764,540	415,030	349,399		2,528,969
Montana	767,051	6,088	27,341	2,991	803,471
New Mexico	3,137,497	2,252,569	839,734	11,203	6,241,003
New York	56,310		660	9,715	66,685
Ohio	549,097		36,500	66,974	652,571
Oklahoma	7,873,220	969,132	2,767,508	16,119	11,625,979
Pennsylvania	520,069		43,250	58,361	621,680
Texas	68,579,797	16,959,726	13,630,880		99,170,403
Utah	65,269		308		65,577
West Virginia	1,587,107		85,500	42,626	1,715,233
Wyoming	1,328,615	148,290	696,298	474	2,173,677
Other States [9]	12,141	6,700	4,264		23,105
Total	126,117,504	27,583,672	26,386,698	288,470	180,381,344

1 Volumes are reported at a pressure base of 14.65 pounds per square inch absolute and at a standard temperature of 60° F.
2 Excludes gas loss due to natural-gas liquids recovery.
3 The net difference between gas stored in and gas withdrawn from underground storage reservoirs.
4 Net production equals gross withdrawals less gas injected into underground reservoirs; changes in underground storage are excluded. December production estimated occasionally.
5 Nonassociated gas is free gas not in contact with crude oil in the reservoir.
6 Associated gas is free gas in contact with crude oil in the reservoir.
7 Dissolved gas is gas in solution with crude oil in the reservoir.
8 Gas held in underground reservoirs for storage purposes only.
9 Includes Alabama, Florida, Maryland, Missouri, Nebraska, and Virginia.

Proved reserves of natural-gas liquids as of December 31, 1949, reported by this committee, were 3,729,012,000 barrels, 5 percent greater than in 1948.

PRODUCTION

GROSS PRODUCTION

Estimated gross production of natural gas in the United States in 1948 was 7,179,000 million cubic feet, an increase of 7 percent over the 1947 production of 6,733,000 million cubic feet. An increased proportion of gas in 1948 was produced from gas wells as compared to oil wells. Gas production from gas wells increased 22 percent, while gas produced from oil wells decreased 13 percent in 1948 as compared to 1947. In 1948 Mississippi again showed the largest percentage increase in gas production—45 percent—and Texas showed the greatest actual gain—208,000 million cubic feet. Production over the last 3 years has decreased in the Michigan and Illinois Basins and in the Appalachian States, except West Virginia. Gas from the large producing States of the Southwest is now being piped in increasing quantities into the markets that can no longer be completely satisfied by these less productive States.

Repressuring and recycling continue to grow in importance as means of increasing the recovery from oil and condensate fields. In 1948, 1,221,000 million cubic feet of gas were used for these purposes—an increase of 137,000 million feet above 1947.

Storage of natural gas in depleted fields close to consuming centers is advantageous as a means of providing fuel for peak demand periods in those communities that receive gas via long transmission lines. The States that have been long-time producers of gas are those best able to use this means of storage. Pennsylvania, Ohio, and West Virginia stored the largest quantities of gas in 1948. The total volume placed in storage in the United States was 136,406 million cubic feet, and the net volume stored was 57,371 million cubic feet—increases over 1947 of 40,090 and 47,698 million cubic feet, respectively. The quantities used for repressuring and recycling and the net quantity placed in storage when subtracted from the estimated gross production provide the volume removed from reserves. This quantity in 1948 was 5,900,827 million cubic feet, an increase of 5 percent over 1947. The percentage increase in withdrawals from reserves is smaller than the corresponding increase in production because of the large reduction in the volume of "vented and waste." This decreased from 1,067,938 million cubic feet in 1947 to 810,178 million cubic feet in 1948. Most of this reduction occurred in Texas and resulted from reduced wastage of casinghead gas from oil wells.

Gross production and disposition of natural gas in the United States, 1947–48, by States, in million cubic feet

State	Production [1]			Disposition		
	From gas wells	From oil wells	Total	Marketed production [2]	Repressuring	Losses and waste [3]
1947						
Arkansas	34,000	40,000	74,000	50,630	11,890	11,480
California	209,700	494,600	704,300	560,510	135,363	8,427
Colorado	5,400	5,900	11,300	8,392	300	2,608
Illinois	400	48,000	48,400	17,023	5,200	26,177
Indiana	630	1,460	2,090	877	1,200	13
Kansas	151,000	92,500	243,500	209,321	1,814	32,365
Kentucky	87,860	10,150	98,010	96,459	1,491	60
Louisiana	466,100	386,500	852,600	581,398	164,934	106,268
Michigan	14,000	24,300	38,300	18,812	133	19,355
Mississippi	27,840	38,140	65,980	40,037	10,813	15,130
Missouri	38		38	38		
Montana	31,560	3,440	35,000	34,282	270	448
New Mexico	27,590	208,570	236,160	142,740	3,741	89,679
New York	4,480	250	4,730	4,600	130	
Ohio	68,860	4,000	72,860	68,946	3,914	
Oklahoma	282,060	367,620	649,680	419,010	16,500	214,170
Pennsylvania	87,070	5,000	92,070	91,971	67	32
Texas	2,038,000	1,204,000	3,242,000	1,992,704	710,302	538,994
Utah	6,040		6,040	6,040		
West Virginia	190,310	7,500	197,810	192,233	3,579	1,998
Wyoming	36,240	21,500	57,740	45,550	11,478	712
Other States [4]	590	32	622	600		22
Total	3,769,768	2,963,462	6,733,230	4,582,173	1,083,119	1,067,938
1948						
Arkansas	40,300	33,410	73,710	53,946	11,000	8,764
California	235,000	513,700	748,700	570,954	167,560	10,186
Colorado	6,500	5,000	11,500	8,967	371	2,162
Illinois	200	39,800	40,000	14,062	4,380	21,558
Indiana	400	1,300	1,700	553	1,135	12
Kansas	177,360	100,640	278,000	245,189	2,913	29,898
Kentucky	64,830	9,500	74,330	70,095	1,233	3,002
Louisiana	554,610	418,390	973,000	686,061	201,707	85,232
Michigan	17,290	6,760	24,050	14,981	2,886	6,183
Mississippi	55,000	41,000	96,000	59,899	30,610	5,491
Missouri	27		27	27		
Montana	34,710	4,000	38,710	36,551	412	1,747
New Mexico	45,310	193,420	238,730	194,749	2,146	41,835
New York	4,600	200	4,800	4,705	93	2
Ohio	66,650	2,000	68,650	65,619	3,023	8
Oklahoma	411,340	262,980	674,320	480,573	20,784	172,963
Pennsylvania	83,670	4,000	87,670	87,578	87	5
Texas	2,530,000	920,000	3,450,000	2,289,923	757,146	402,931
Utah	6,640	10	6,650	6,610		40
West Virginia	200,500	7,500	208,000	203,681	2,084	2,235
Wyoming	52,850	26,430	79,280	52,424	11,009	15,847
Other States [4]	760	190	950	873		77
Total	4,588,547	2,590,230	7,178,777	5,148,020	1,220,579	810,178

[1] Marketed production plus quantities used in repressuring, lost, and wasted (see footnote 3).
[2] Includes gas stored and lost in transmission.
[3] Includes gas (mostly residue) blown to the air but does not include direct waste on producing properties, except where data are available.
[4] Florida, North Dakota, South Dakota, Tennessee, and Virginia.

Natural gas stored underground in and withdrawn from storage fields, by States of location, 1947–48, in million cubic feet

State	1947			1948		
	Total stored	Total withdrawn	Net stored	Total stored	Total withdrawn	Net stored
Arkansas	7		7		10	−10
California	9,297	11,291	−1,994	9,767	12,197	−2,430
Illinois	294	5	289	171	57	114
Indiana	544	433	111	533	357	176
Kansas	11,323	8,790	2,533	10,494	9,738	756
Kentucky	1,149	1,932	−783	9,387	2,029	7,358
Michigan	4,712	8,804	−4,092	10,479	4,047	6,432
Montana	1,377	608	769	2,638	714	1,924
New Mexico	261	87	174	253	91	162
New York	2,668	2,702	−34	5,174	2,030	3,144
Ohio	18,136	15,979	2,157	27,549	13,352	14,197
Oklahoma	4,987	3,776	1,211	4,555	4,701	−146
Pennsylvania	19,230	15,297	3,933	28,835	14,586	14,249
Texas	4,012	27	3,985	6,839	12	6,827
West Virginia	17,692	16,907	785	17,156	15,045	2,111
Wyoming	627	5	622	2,576	69	2,507
Total	96,316	86,643	9,673	136,406	79,035	57,371

MARKETED PRODUCTION

Marketed production of natural gas in 1948 increased 12 percent to 5,148,020 million cubic feet. This quantity includes gas stored and that lost in transmission. Texas, Louisiana, California, and Oklahoma remain the largest suppliers of marketed gas.

Beginning with 1947 statistics, marketed production of natural gas was reported on a new basis to include net volume stored and lost in transmission. Figures for years before 1947 were not tabulated on a basis comparable with the new series, but estimates for 1929–46 on the new basis are compared in the following table with the old series.

Year	Million cubic feet		Year	Million cubic feet	
	Old basis	New basis		Old basis	New basis
1929	1,917,693	1,952,166	1939	2,476,756	2,538,383
1930	1,943,421	1,978,911	1940	2,660,222	2,733,819
1931	1,686,436	1,721,902	1941	2,812,658	2,893,525
1932	1,555,990	1,593,798	1942	3,053,475	3,145,694
1933	1,555,474	1,596,673	1943	3,414,689	3,515,531
1934	1,770,721	1,815,796	1944	3,711,039	3,815,024
1935	1,916,595	1,968,963	1945	3,918,686	4,042,002
1936	2,167,802	2,225,477	1946	4,030,605	4,152,762
1937	2,407,620	2,473,483	1947		4,582,173
1938	2,295,562	2,358,201	1948		5,148,020

Marketed production of natural gas in the United States, by States, 1944–48, in million cubic feet

Year	Arkansas	California	Colorado	Illinois	Indiana	Kansas	Kentucky	Louisiana	Michigan	Mississippi	Montana	New Mexico
1944	46,453	502,017	5,141	18,137	1,014	157,733	94,223	534,688	19,653	1,352	32,102	87,727
1945	46,600	502,442	4,914	16,663	1,543	145,959	81,714	542,789	21,874	4,587	31,829	105,023
1946	45,177	487,904	6,728	17,166	1,094	165,725	70,396	525,178	20,879	7,225	30,713	119,262
1947 [1]	50,630	560,510	8,392	17,023	877	209,321	96,459	581,398	18,812	40,037	34,282	142,740
1948 [1]	53,946	570,954	8,967	14,062	553	245,189	70,095	686,061	14,981	59,899	36,551	194,749

Year	New York	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Other States	Total	Value at wells: Total (thousands of dollars)	Value at wells: Average (cents per M)
1944	7,052	51,724	310,888	92,987	1,525,515	181,452	34,521	6,660	3,711,039	189,809	5.1
1945	9,210	49,967	357,530	82,188	1,711,401	160,225	35,282	6,946	3,918,686	191,006	4.9
1946	5,084	61,570	380,938	92,443	1,776,148	178,958	33,266	4,751	4,030,605	212,251	5.3
1947 [1]	4,600	68,946	419,010	91,971	1,992,704	192,233	45,550	6,678	4,582,173	274,709	6.0
1948 [1]	4,705	65,619	480,573	87,578	2,289,923	203,681	52,424	7,510	5,148,020	333,173	6.5

[1] Includes gas stored and lost in transmission.

Natural gas produced and consumed in the United States in 1948, by States

State	Marketed production [1]: Quantity [1]: Million cubic feet	Marketed production: Quantity: Percent of total	Marketed production: Estimated value at wells: Total (thousand dollars)	Marketed production: Estimated value at wells: Average per M (cents)	Consumption (including receipts from other States): Quantity: Million cubic feet	Consumption: Quantity: Percent of total	Consumption: Value at points of consumption: Total (thousand dollars)	Consumption: Value at points of consumption: Average per M (cents)
Alabama					61,113	1.2	15,217	24.9
Arizona					34,983	.7	10,579	30.2
Arkansas	53,946	1.0	2,422	4.5	112,675	2.3	16,229	14.4
California	570,954	11.1	64,803	11.3	617,615	12.5	206,885	33.5
Colorado	8,967	.2	539	6.0	60,585	1.2	17,822	29.4
District of Columbia					9,361	.2	11,859	126.7
Florida	27	(2)	1	3.7	8,973	.2	1,768	19.7
Georgia					47,552	1.0	15,704	33.0
Illinois	14,062	.3	1,735	12.3	168,796	3.4	79,428	47.1
Indiana	553	(2)	54	9.8	50,774	1.0	27,826	54.8
Iowa					50,350	1.0	18,469	36.7
Kansas	245,189	4.8	12,235	5.0	199,893	4.0	40,284	20.2
Kentucky	70,095	1.4	12,897	18.4	41,357	.8	17,226	41.7
Louisiana	686,061	13.3	26,482	3.9	426,837	8.6	45,888	10.8
Maryland					4,280	.1	4,422	103.3
Michigan	14,981	.3	2,195	14.7	75,978	1.5	54,737	72.0
Minnesota					52,376	1.1	20,742	39.6
Mississippi	59,899	1.2	3,336	5.6	65,245	1.3	13,942	21.4
Missouri	27	(2)	5	18.5	90,883	1.8	35,369	38.9
Montana	36,551	.7	1,696	4.6	32,919	.7	9,012	27.4
Nebraska					47,647	1.0	17,100	35.9
New Mexico	[3] 194,749	3.8	5,258	2.7	110,132	2.2	10,981	10.0
New York	[4] 4,705	.1	1,040	22.1	44,200	.9	33,296	75.3
North Dakota	643	(2)	19	3.0	2,712	.1	1,201	44.3
Ohio	65,619	1.3	12,901	19.7	236,137	4.8	126,210	53.4
Oklahoma	480,573	9.3	23,356	4.9	277,955	5.6	39,014	14.0
Pennsylvania	[5] 87,578	1.7	21,124	24.1	191,631	3.9	88,405	46.1
South Dakota	2	(2)	(6)	6.5	8,540	.2	3,195	37.4
Tennessee	127	(2)	12	9.4	37,766	.8	13,308	35.2
Texas	[7] 2,289,923	44.5	103,505	4.5	1,605,955	32.5	147,918	9.2
Utah	6,610	.1	397	6.0	21,627	.4	6,548	30.3
Virginia	74	(2)	7	9.5	3,877	.1	4,451	114.8
West Virginia	203,681	3.9	34,035	16.7	112,702	2.3	32,024	28.4
Wisconsin					323	(2)	383	118.6
Wyoming	52,424	1.0	3,119	5.9	31,400	.6	5,917	18.8
Total 1948	5,148,020	100.0	333,173	6.5	4,945,149	100.0	1,193,359	24.1
1947	4,582,173	100.0	274,709	6.0	4,426,544	100.0	1,028,318	23.2

[1] Includes gas stored and lost in transportation.
[2] Less than 0.05 percent.
[3] Includes 2,187 million cubic feet piped to Mexico.
[4] Includes 42 million cubic feet piped to Canada.
[5] Includes 151 million cubic feet piped to Canada.
[6] Less than $500.
[7] Includes 16,324 million cubic feet piped to Mexico.

NUMBER OF WELLS

In 1948, 2,897 new gas wells were drilled and 2,355 were abandoned, which left 64,212 active wells at the end of the year. The over-all number of completions in 1949 was 2,887, very close to the 1948 figure. Large changes did take place in regional drilling activity in 1949. An increased number of wells was drilled in Texas and Louisiana and a decreased number in West Virginia and Ohio.

Drilling did not offset abandonments in 1948 in Indiana, Michigan, New York, Ohio, and Pennsylvania. Abandonments were highest in Ohio (597) and Pennsylvania (528). In Texas 442 wells were abandoned; but new drilling offset this, and the number of active wells increased in 1948 by 100.

Gas wells in the United States, 1947–49, by States

State	Producing Dec. 31, 1947	Drilled during 1948 [1]	Producing Dec. 31, 1948	Drilled during 1949 [1]
Arkansas	160	5	165	3
California	350	21	365	40
Colorado	20	10	30	4
Illinois	100	11	100	6
Indiana	830	40	800	30
Kansas	2,700	382	3,000	419
Kentucky	[2] 3,350	151	3,480	193
Louisiana	2,100	133	2,210	211
Michigan	760	30	700	23
Mississippi	60	16	75	5
Missouri	100	3	100	[3] 6
Montana	700	69	760	54
New Mexico	220	44	230	53
New York	1,700	------	1,600	------
Ohio	7,190	407	7,000	308
Oklahoma	3,250	258	3,400	213
Pennsylvania	19,100	228	18,800	215
Tennessee	(2)	1	18	------
Texas	5,000	542	5,100	746
West Virginia	15,800	535	16,100	344
Wyoming	150	7	145	8
North Dakota, South Dakota, Utah, and Virginia	30	4	34	6
Total	63,670	2,897	64,212	2,887

[1] From Oil and Gas Journal.
[2] Tennessee included with Kentucky.
[3] Includes Nebraska.

DEVELOPMENT AND PRODUCTION BY STATES[1]

Arkansas.—J. W. Sanders, chief engineer, Arkansas Oil and Gas Commission, reports that gas production from oil and condensate wells in south Arkansas decreased in 1949 to 58,880 million cubic feet from 65,620 million in 1948. This decrease is attributed to the reduction in allowables in controlled oil and condensate fields. Production from gas wells in north Arkansas increased from 5,703 million cubic feet in 1948 to 6,901 in 1949. The number of producing wells here on December 31, 1949, was 187, two less than the previous year. Two new gas fields were discovered—the Cecil field in Franklin County and the Rudy field in Crawford County. Neither were completely tested at year end. The Columbia pool remained shut-in for lack of market.

[1] Based on latest available trade publications and reports from Federal and State agencies.

California.—The California Department of Natural Resources reports that the net withdrawal of natural gas from formation in 1949 was 546,026 million cubic feet compared with 571,643 million in 1948. The 1949 production comprised 165,267 million cubic feet from dry gas wells, 380,759 million from oil wells, and in addition 35,118 million shrinkage at gasoline and recycling plants. The receipts of natural gas via pipeline from Texas increased from 65,560 million cubic feet in 1948 to 94,099 million in 1949.

Eight wildcat gas wells and 32 development wells are reported to have been completed during the year. Reserves added by discovery and development did not equal production in 1949, and estimated reserves of natural gas decreased by 201,000 million cubic feet.

Colorado.—J. R. Schwabrow, Federal Geological Survey, reports that the only gas discovery in Colorado in 1949 was Asbury Creek field in Mesa County. One noncommercial well was completed there which produced from the Dakota formations at 2,836 to 2,933 feet. Three outpost wells drilled in the Dove Creek field, a 1948 discovery, were dry.

A gasoline plant completed at the end of 1948 in the Rangely field treated 5,406 million cubic feet of gas in 1949.

Net production increased from 9,002 million cubic feet in 1948 to 13,529 million in 1949. This increase is attributed almost entirely to increased field use and larger losses in the Rangely field.

Illinois.—A. H. Bell and D. H. Swann, Illinois Geological Survey Division, report that two gas wells in the Dudley pool and one each in the Waverly and Omaha fields were completed and shut-in during 1949. Two gas wells in Louden field and one in Cottonwood field were completed and are producing. One well in Flat Rock field, formerly shut-in, was opened during 1949.

It is estimated that nearly 60 billion cubic feet of casinghead gas were produced in 1949, of which approximately 45 billion were used untreated in the field or vented. Only 13.5 billion cubic feet were treated at natural-gasoline plants. Of the resulting 9.5 billion cubic feet of residue gas, 3.1 billion were returned to the formation and about 6.0 billion were used as plant and lease fuel. Other natural gas marketed amounted to 378 million cubic feet.

Indiana.—H. R. Brown of the Indiana Department of Conservation reports that 35 gas wells were completed in 1949. The reserves committee of the American Gas Association reported net natural-gas production of 6,250 million cubic feet in 1949 compared with 5,504 million in 1948.

Kansas.—Earl K. Nixon, Kansas State Geological Survey, reports that four new gas pools were discovered in Kansas in 1949. The Jones pool and Jones Northeast pool, both in Harvey County, produce from the Mississippian formation. In Cowley County, the Mansur pool produces from the Layton sand and the Kansas City-Lansing limestone, and the New Salem pool from the Layton sand.

The west side of the Hugoton field in Morton County was extended 6 or 7 miles by completion of two outpost wells, each rated at nearly 10 million cubic feet per day. Its eastern boundary in Seward County was extended by a score or more wells with initial capacities of 15 to 25 million cubic feet daily. Approximately 91,000 acres were added

to the total area of the Hugoton field, which totaled 2,005,500 acres as of the end of 1949.

In 1949, 425 gas wells were completed in Kansas compared with 351 in 1948. The Hugoton field accounted for 405 of the 1949 completions. Natural-gas production in 1949 is reported to have been 263 billion cubic feet. The Hugoton field, producing from 1,847 wells, accounted for 221 billion cubic feet, an increase of 33 percent over 1948.

Kentucky.—C. D. Hunter, chief geologist, Kentucky West Virginia Gas Co., reports that gas-well completions in 1949 were just slightly below the 1948 figure. In all, 189 wells with an initial open-flow capacity of 163 million cubic feet per day were completed in the State. Of these wells, 149 were in the Big Sandy field. Only two wildcat gas wells were brought in in 1949. Both were in the less productive western part of the State.

The committee on natural-gas reserves of the American Gas Association estimates 1949 net production to have been 90,000 million cubic feet. This was greater than the quantity of new reserves discovered and estimates of proved reserves decreased by 29,000 million cubic feet.

Louisiana.—The Louisiana Department of Conservation Petroleum Activity Report for 1949 reports production of natural gas for the year to have been 1,018,262 million cubic feet. This was 5 percent above the production for 1948. It was reported that 377 gas and condensate wells were completed in 1949, of which 137 were in the Monroe field. Wildcat discoveries included 15 gas-condensate wells and 5 gas wells. The gas-well discoveries, by field and parish, were Midland, Acadia; South Arnaudville, St. Martin; West Delta Block 27 and Block 30, Plaquemines; and South Sarepta, Bossier. Gas-condensate discoveries by field and parish were Bayou Plaquemines, Iberville; Black Bay, Plaquemines; Burton, St. James; Eugene Island Block 110, South Tiger Lagoon, and Lake Sand, all in Iberia; Outside Island, Vermilion Block 39 and 76, Vermilion; North Welsh, Jefferson Davis; Ship Shoal Block 28 and Turtle Bayou, Terrebonne; and West Cameron Blocks 33, 45, and 149, Cameron.

Michigan.—G. E. Eddy, State geologist, Michigan Department of Conservation, reports that in 1949 38 new gas wells were completed and 54 facility wells were drilled in gas-storage fields. The total number of completions was 16 less than in the previous year.

Eight new fields were discovered during the year, although only the Isabella field in Isabella County promises to be significant. The State geologist reports that the Howell field produced 3,971 million cubic feet, about 27 percent of the State's total 1949 production of 14,500 million cubic feet. The reported 1948 production was 21,370 million cubic feet.

A large increase in the consumption of natural gas in Michigan was made possible in 1949 by completion of the Michigan-Wisconsin pipeline from the Southwest.

Mississippi.—The number of gas wells completed declined from 16 in 1948 to 5 in 1949. One wildcat was brought in in Marian County; three development wells were completed in the Baxterville field and one in the Hub field. H. M. Morse, supervisor, Mississippi State Oil and Gas Board, reports that delivery of natural gas to pipelines was

62,979 million cubic feet in 1949, almost double that of 1948. Over 70 percent of the gas, 44,460 million cubic feet, originated in the Gwinville field. The Baxterville field supplied 4,682 million; the Carthage field, 5,982 million; the Soso field, 6,420 million; the Sandy Hook field, 87 million; the Hub field, 879 million; the Jackson field, 289 million; and the Fayette field, 180 million cubic feet. No pipeline facilities were available at the Rodney, Sherron, Roxie, and McBride fields.

Missouri.—Frank C. Greene, district geologist, Missouri Division of Geological Survey and Water Resources, reported that five gas wells were completed in Missouri in 1949. Three of these wells were near Lisle, Cass County, and had a reported initial open flow of 2 million cubic feet per day. Two wells south of Harrisonville, Cass County, were brought in with an initial open flow of 370 thousand cubic feet per day.

Production of natural gas decreased from 31 million cubic feet in 1948 to 23 million in 1949.

Montana.—J. R. Schwabrow, Federal Geological Survey, reports a total of 65 gas-well completions with a combined open flow of 152 million cubic feet per day in Montana in 1949. Only one wildcat well was of commercial size. This was the Devil's Pocket well (Pet anticline), which had an initial flow of 32 million cubic feet per day.

Gas utilization is still limited by distribution facilities. A 6-inch pipeline was laid from the Telstad compressor station to the Utopia field, which started production in December. The sweetening plant under construction in the Cut Bank field was completed and began processing gas from Cut Bank and Reagan fields on October 25. Eastern Montana will receive gas from a pipeline under construction from the Worland field in Wyoming. Net production of natural gas in 1949 was reported to be 41,200 million cubic feet of which 1,400 million was loss. The corresponding 1948 figures were 40,200 million and 1,800 million.

New Mexico.—Information received from Foster Morell, Federal Geological Survey, indicates that two gas fields were discovered in the San Juan Basin of northwest New Mexico in 1949. These were the La Plata (three wells) and the Gavilan (one well) fields. The importance of these fields is still undetermined. Seventeen other wells were completed in the San Juan Basin, 14 of which were in the Fulcher Basin-Kutz Canyon field.

In northwestern New Mexico dry-gas deliveries to all residential, commercial, and industrial consumers rose to 11,544 million cubic feet from 9,300 million in 1948.

In southeastern New Mexico 47 gas wells were completed in Lea County compared with 35 in 1948. No major discoveries in this region and no gas completions in Eddy County were reported for 1949.

Production of gas in southeastern New Mexico declined from 207,852 million cubic feet in 1948 to an estimated 202,687 million in 1949. This production consisted of 37,150 million cubic feet of dry gas and 165,537 million of casinghead gas. Of this quantity, 170,011 million cubic feet were marketed.

In central New Mexico no gas wells were completed in 1949. Production of natural carbon dioxide from the Bueyeros field, Harding County, increased to 87 million cubic feet from 73 million in 1948.

New York.—W. L. Kreidler, senior geologist, New York Geological Survey, reported that production of natural gas in 1949 had declined to about 3,500 million cubic feet from 4,500 million in 1948. Twenty-five wells were drilled into the Medina and 10 wells into the Oriskany formations, but none resulted in commercial production. Four facility wells were drilled in gas-storage fields.

North Dakota.—Wilson M. Laird, State geologist of the North Dakota Geological Survey, reported that 26 wells were producing gas in the State in 1949, one more than in 1948, and that no permits had been issued for gas-well drilling during the year. The production of gas decreased to 529 million cubic feet in 1949 from 643 million cubic feet in 1948.

Ohio.—A summary of Ohio oil and gas activities prepared by R. L. Alkire of the Ohio Geological Survey states that the number of gas completions and average open flow per well declined in 1949 as compared to 1948. The number of gas wells completed declined from 493 (revised figure) to 292. Of these, 138 produced from the Clinton group and 73 in the Berea. The average initial open-flow capacity for all new gas wells was 676 thousand cubic feet per day; however, the average flow from those wells in the Clinton was 1,146 thousand.

The largest gas well brought in was in section 15, Brush Creek Township, Muskingum County. The initial open flow was 10.4 million cubic feet per day from the Clinton sand at 3,886 feet.

Discoveries and extensions to old fields added 51 billion cubic feet to proved reserves. Approximately 4,000 acres of new pools and 7,800 acres of extensions to old fields were proved. Net production for the year was 47,000 million cubic feet, according to the American Gas Association committee on natural-gas reserves.

Oklahoma.—Gas-well completions in 1949 numbered 213, about 40 less than in 1948. Eighty-eight of these were in the Hugoton field. Eleven new gas fields were discovered, four of which were in Hughes County. The most productive discovery well was in the Dustin Southeast field in Hughes County, which tested 15 million cubic feet per day on a ⅜-inch choke.

New gas production in 1949, according to the American Gas Association committee on natural-gas reserves, was 567,335 million cubic feet. In 1948 this committee reported production of 674,315 million cubic feet.

Pennsylvania.—J. G. Montgomery, Jr., vice-president, United Natural Gas Co., reports that 446 gas wells were completed in Pennsylvania in 1949. Of these, 430 produced from Upper Devonian strata and had an initial open flow of 93.4 million cubic feet per day. Three new fields were discovered, although only the one in Indiana County is considered to have commercial significance.

Greatest activity in Oriskany sand drilling was in Potter and Cameron Counties where 13 wells were completed with an initial open flow capacity of 60.5 million cubic feet per day. A well brought in in Westmoreland County from the Oriskany sand is significant in that

it strengthens the possibility of a northeast-southwest trend from Fayette County to Cameron and Potter Counties.

The deepest well in Pennsylvania and the deepest cable-tool well in the world was drilled to 10,312 feet in Fayette County.

Many depleted wells and about 50 new wells were utilized in conjunction with underground storage reservoirs.

The reserves committee of the American Gas Association reports that net natural-gas production in 1949 was 70,000 million cubic feet compared to a corresponding 1948 production of 74,592 million.

South Dakota.—J. R. Schwabrow, Federal Geological Survey, reports there were no natural-gas developments in 1949. An estimated 8 million cubic feet of gas were marketed and 4 million lost from the gas-water wells at Pierre. This was almost unchanged from 1948.

Tennessee.—H. C. Milhous, assistant geologist, Tennessee Department of Conservation, reports that there were no developments in gas production in 1949. Production decreased from 157.5 million cubic feet in 1948 to 137 million in 1949 due to the mild 1949 winter.

Texas.—The production of natural gas in Texas as reported by the Texas Railroad Commission increased 7 percent in 1949 to 3,519,173 million cubic feet, including 798,211 million returned to formation. This increase was predominantly from gas wells. Gas-well completions totaled 746 for the year, of which 112 were wildcats. As usual, the Panhandle had the greatest number of gas-well completions—310 in 1949—more than double the number reported for 1948. In Sherman County alone 112 wells were completed and 1 new field, as yet unnamed, was found.

The majority of the wildcat wells were drilled in the South and Gulf Coast regions. The discovery in south Texas that held the most promise was the Clayton gas-condensate field in western Live Oak County. Production is from the Wilcox formation. The field has been extended 2 miles southwest and 3½ miles northeast of the discovery well.

There were numerous gas discoveries on the Gulf coast, most of them of little importance. The Todd-field discovery in southeast Grimes County was the first commercial production in this county. This, with the nearby gas-condensate discovery in the northeast corner of Waller County and the New Ulm area in Austin County, holds promise for the previously undeveloped strip across the juncture of these counties. A gas well was completed in the Gulf of Mexico, 18 miles off Galveston County, and produced over 5 million cubic feet of gas and about 50 barrels of condensate per day on a ¼-inch choke.

East Texas opened six new gas fields, two in Harrison County. One of these—Woodlawn—had been shut-in since completion of the discovery well in 1947 for lack of market. The other, the North Laning field, is probably the most promising discovery in east Texas in 1949. It produces from the Young zone of the Rodessa formation.

Utah.—J. R. Schwabrow, Federal Geological Survey, reports no natural-gas developments in Utah in 1949. The South Last Chance

area was abandoned. The production of carbon dioxide gas in the Farnham field decreased from 156 million cubic feet in 1948 to 94 million in 1949. Marketed production of natural gas from the Clay Basin field was 6,126 million cubic feet compared with 6,610 million in 1948. In addition, an unreported quantity of gas was produced in 1949 from oil wells in the new Ashley Valley and Roosevelt fields.

West Virginia.—Paul H. Price, state geologist of West Virginia, reported 427 gas completions in the State in 1949. In 1948, 590 gas wells were completed. The initial open-flow gas production of all new wells was 352 million cubic feet per day, an average flow per well of 824 thousand cubic feet daily. The greatest number of new producing gas wells was reported in Wayne, Lincoln, Wyoming, and Raleigh Counties.

Net gas production as reported by the American Gas Association, reserves committee, was 180,000 million cubic feet in 1949, a decline of 26,000 million from 1948.

Wyoming.—J. R. Schwabrow, Federal Geological Survey, reports that 10 gas wells were completed in Wyoming in 1949, which had a combined open flow of 135 million cubic feet per day. One new field was found at Salt Wells, south of Baxter. The discovery well's open-flow production is estimated at 10 million cubic feet per day from the Dakota formation.

Plant construction was among the year's most important developments. A 12-million-cubic-feet-per-day combination gasoline and sulfur-extraction plant in the Elk Basin field began operation. At the Worland field a natural-gasoline plant and a sulfur-extraction plant were nearing completion at the end of the year. These will treat 30 million cubic feet of sour gas per day. The residue gas will be transported via pipeline to eastern Montana. These plants will be significant in reducing the waste of sour gas in the State, two-thirds of which occurred in the Worland field. Net production according to the report increased from 61 billion cubic feet in 1948 to 72 billion in 1949.

INTERSTATE SHIPMENTS AND EXPORTS

The interstate shipment of natural gas continued as the most rapidly growing activity of the industry. Shipments increased by 25 percent in 1948 to 1,756,629 million cubic feet. This is the largest increase yet recorded in a single year. Texas again produced the largest quantity of gas for interstate shipments, followed by Louisiana and Oklahoma. Kansas, which ranked fourth in gross exports, imported 155 billion cubic feet in 1948. Thus on a net basis it is little more than self-sufficient in natural gas.

The importing States, in the order of their gross receipts in billions of cubic feet, were Ohio, 201; Illinois, 161; Kansas, 155; and Pennsylvania, 142.

Exports to Mexico increased from 17,942 million cubic feet in 1947 to 18,511 million in 1948. Exports to Canada decreased from 207 million cubic feet in 1947 to 193 million in 1948.

Interstate transportation of natural gas in 1948 [1]

Producing State	Consuming State [1]	Million cubic feet [2]
Arkansas	Texas	2,286
Colorado	Utah	6,051
	Wyoming	59
		6,110
Indiana	Illinois	22
Kansas	Colorado	19,995
	Illinois	9,008
	Indiana	11,641
	Iowa	23,221
	Michigan	30,854
	Minnesota	32,012
	Missouri	10,347
	Nebraska	32,854
	Ohio	10,800
	Oklahoma	1,323
	South Dakota	3,468
		185,523
Kentucky	District of Columbia	6,500
	Illinois	34
	Indiana	837
	Maryland	1,709
	New York	60
	Ohio	5,082
	Pennsylvania	16,480
	Virginia	1,149
	West Virginia	10,670
		42,521
Louisiana	Alabama	31,376
	Arkansas	49,640
	Florida	5,292
	Georgia	21,975
	Illinois	26,781
	Indiana	3,147
	Kentucky	2,055
	Maryland	40
	Mississippi	31,243
	Missouri	33,338
	New York	6,348
	Ohio	22,747
	Pennsylvania	14,379
	Tennessee	29,442
	Texas	16,317
	Virginia	19
	West Virginia	345
		294,484
Mississippi	Alabama	15,504
	Florida	2,423
	Georgia	11,538
	Louisiana	7,239
		36,704
Montana	North Dakota	3,099
	South Dakota	2,490
		5,589
New Mexico	Arizona	29,260
	California	51,516
	Colorado	599
	Mexico	2,187
	Texas	9,058
		92,620
New York	Canada	42
	Pennsylvania	440
		482
North Dakota	South Dakota	643

See footnotes at end of table.

Interstate transportation of natural gas in 1948 [1]—Continued

Producing State	Consuming State [1]	Million cubic feet [2]
Ohio	West Virginia	535
Oklahoma	Arkansas	4,600
	Illinois	9,245
	Indiana	10,384
	Iowa	1,079
	Kansas	101,227
	Michigan	21,280
	Minnesota	962
	Missouri	34,809
	Nebraska	1,666
	Ohio	7,501
	South Dakota	75
	Texas	13,336
	Wisconsin	11
		206,175
Pennsylvania	Canada	151
	Maryland	631
	New York	16,246
	West Virginia	1,156
		18,184
Texas	Alabama	14,805
	Arizona	7,967
	Arkansas	8,439
	California	14,044
	Colorado	40,024
	Florida	1,231
	Georgia	14,268
	Illinois	115,668
	Indiana	26,864
	Iowa	29,068
	Kansas	53,773
	Kentucky	23,296
	Louisiana	28,021
	Maryland	614
	Mexico	16,324
	Michigan	19,830
	Minnesota	20,469
	Mississippi	10,807
	Missouri	14,590
	Nebraska	14,051
	New Mexico	8,165
	New York	15,232
	Ohio	97,346
	Oklahoma	16,429
	Pennsylvania	51,823
	South Dakota	2,216
	Tennessee	9,340
	Virginia	1,109
	West Virginia	39,769
	Wisconsin	418
	Wyoming	1,617
		717,617
Virginia	Tennessee	28
West Virginia	District of Columbia	3,308
	Maryland	1,519
	New York	7,881
	Ohio	57,616
	Pennsylvania	59,306
	Virginia	1,768
		131,398
Wyoming	Montana	3,881
	Nebraska	2,493
	Utah	9,336
		15,710
Total United States		1,756,629

[1] Includes:
Exports to Canada—193 million cubic feet.
Exports to Mexico—18,511 million cubic feet.
[2] Includes gas stored and lost in transmission.

PIPELINES

Pipeline construction in 1949 proceeded unhampered, except by some scarcity of large-diameter pipe. The Federal Power Commission in 1949 issued 91 certificates of public convenience and necessity authorizing 7,537 miles of pipeline estimated to cost $570,408,000 and to increase delivery capacity of the lines by over 1 trillion cubic feet per year. This compares with 1948 authorizations estimated to cost $424,598,000 and to increase the delivery capacity of natural-gas pipelines by over 500 billion cubic feet per year. Still pending before the Commission are applications for construction that would add another 1.7 trillion cubic feet per year to this capacity.

Among the largest pipeline projects authorized in 1949 is the 20- to 26-inch line to be built by Tennessee Gas Transmission Co. from northeastern Kentucky to the Buffalo, N. Y., area. In all, over 100 cities of greater than 50,000 population will benefit by projects authorized in 1949.

CONSUMPTION

Consumption of natural gas increased to 4,945,000 million cubic feet in 1948 from 4,426,000 million in 1947. The increase was divided almost equally percentagewise between domestic, 12-percent increase;

Natural gas consumed in the United States, 1944–48

Year	Domestic and commercial consumption							
	Number of consumers (thousands)[1]			Billion cubic feet			Average M cubic feet used per consumer	Average value at point of consumption (cents per M)
	Domestic	Commercial	Total	Domestic	Commercial	Total		
1944	10,669	845	11,514	562	221	783	68.0	61.4
1945	10,959	889	11,848	607	230	837	70.7	61.2
1946	11,472	965	12,437	661	242	903	72.6	60.9
1947	12,204	1,039	13,243	802	285	1,087	82.1	60.0
1948	13,508	1,145	14,653	896	323	1,219	83.2	59.6

Year	Industrial consumption							Total consumption		Electric public utility power plants (billion cubic feet)[3]
	Billion cubic feet						Average value at point of consumption (cents per M)	Billion cubic feet	Average value at point of consumption (cents per M)	
	Field	Carbon-black manufacture	Petroleum refineries	Portland-cement plants[2]	Other industrial	Total industrial				
1944	855	356	315	35	1,352	2,913	10.8	3,696	21.5	360
1945	917	432	339	38	1,337	3,063	10.5	3,900	21.4	326
1946	898	478	331	58	1,345	3,110	10.7	4,013	22.0	307
1947	934	485	364	60	1,496	3,339	11.3	4,426	23.2	373
1948	1,022	481	441	72	1,710	3,726	12.5	4,945	24.1	478

[1] Includes consumers served with natural gas mixed with other fuel gases.
[2] From Cement Chapters in Minerals Yearbook.
[3] Federal Power Commission. These figures include some manufactured gas and are therefore shown separately. The natural gas component in these figures is included with "Other Industrial."

Natural gas consumed in the United States, 1944–48, by States, in million cubic feet

State	1944	1945	1946	1947	1948
Alabama	44,323	43,417	45,445	50,713	61,113
Arizona	23,908	22,488	24,198	27,768	34,983
Arkansas	94,783	91,198	87,668	102,779	112,675
California	502,017	502,442	487,904	548,382	617,615
Colorado	33,101	34,877	40,418	49,027	60,585
District of Columbia	6,782	6,883	7,428	8,474	9,361
Florida	6,545	7,331	7,065	7,891	8,973
Georgia	35,603	35,915	36,679	41,368	47,552
Illinois	123,325	121,366	124,284	132,153	168,796
Indiana	38,581	40,274	40,185	42,528	50,774
Iowa	27,307	27,794	33,163	40,948	50,350
Kansas	143,814	160,406	175,820	191,952	199,893
Kentucky	24,399	26,802	29,494	36,938	41,357
Louisiana	310,127	325,888	331,364	375,206	426,837
Maryland	2,491	2,584	2,830	3,402	4,280
Michigan	56,077	59,594	69,251	80,571	75,978
Minnesota	35,229	35,930	37,624	43,198	52,376
Mississippi	33,111	38,297	41,778	52,461	65,245
Missouri	65,046	72,059	74,257	78,101	90,883
Montana	29,019	29,575	28,212	30,919	32,919
Nebraska	24,699	28,235	33,572	39,699	47,647
New Mexico	55,284	71,459	85,662	102,766	110,132
New York	27,057	29,577	32,892	41,572	44,200
North Dakota	2,267	2,640	2,519	2,608	2,712
Ohio	166,785	172,258	188,527	221,571	236,137
Oklahoma	249,996	249,927	245,981	254,522	277,955
Pennsylvania	148,675	149,092	158,587	175,906	191,631
South Dakota	7,688	7,158	7,526	8,016	8,540
Tennessee	24,693	24,419	24,344	33,986	37,766
Texas	1,221,383	1,348,140	1,366,457	1,444,422	1,605,955
Utah	20,275	20,264	15,733	20,919	21,627
Virginia	1,694	1,791	2,101	3,055	3,877
West Virginia	88,953	88,757	100,733	106,105	112,702
Wisconsin	----------	----------	86	267	323
Wyoming	21,426	21,642	23,143	26,351	31,400
Total United States	3,696,463	3,900,479	4,012,930	4,426,544	4,945,149

commercial,[2] 13-percent increase; and industrial users, 12-percent increase. Approximately 75 percent of all marketed natural gas was used by industrial consumers. The three largest consuming States were again Texas, using 32 percent; California, 12 percent; and Louisiana, 9 percent.

Treated for Natural Gasoline.—The quantity of natural gas processed at natural-gasoline and cycle plants increased 8 percent in 1948 to 4,394,000 million cubic feet. Texas remained the largest processor while Louisiana, New Mexico, and Oklahoma showed large percentage increases. Reductions in the volume of gas treated took place in Illinois, Michigan, Ohio, and Pennsylvania. Colorado began processing gas for the first time in 1948.

The ratio of gas treated to gas consumed declined from 0.92 in 1947 to 0.89 in 1948.

[2] "Commercial" uses comprise stores, hotels, theaters, etc.

Natural gas treated at natural-gasoline and cycle plants in the United States, 1944–48, by States, in million cubic feet

State	1944 [1]	1945	1946	1947	1948
Arkansas	53,539	55,725	53,246	60,474	60,265
California	397,860	420,482	414,881	460,046	474,607
Colorado					364
Illinois	32,000	27,690	25,161	22,720	19,545
Kansas	158,524	165,538	189,834	216,644	230,119
Kentucky	48,746	41,562	41,447	38,717	44,748
Louisiana	307,912	310,614	308,723	345,975	405,101
Michigan	3,330	4,271	3,253	2,255	1,586
Mississippi				8,079	32,325
Montana	11,630	12,000	10,000	12,066	13,615
New Mexico	103,277	116,539	123,234	130,693	177,191
New York	4	3	10	12	12
Ohio	40,482	35,210	31,898	32,869	24,366
Oklahoma	191,610	193,744	207,139	236,673	266,479
Pennsylvania	53,672	42,565	38,084	52,437	37,289
Texas	1,682,738	2,039,983	2,012,357	2,235,185	2,382,804
West Virginia	195,000	166,037	181,903	193,044	193,086
Wyoming	19,676	21,907	22,590	22,261	29,998
Total	3,300,000	3,653,870	3,663,760	4,070,150	4,393,500
Ratio to total consumption	.89	.94	.91	.92	.89

[1] Partly estimated.

Domestic and Commercial.—Domestic consumption of natural gas increased 94,000 million cubic feet in 1948 to 896,000 million cubic feet. The number of domestic consumers increased by about 1,300,000 to 13,508,000. The increase in the number of consumers was greatest in Pennsylvania—512,000. This was due mainly to the initiation of deliveries of natural gas to the Philadelphia area by the Texas Eastern Transmission Corp. through the "big-inch" and "little-inch" pipelines. These consumers are not new users of gas but now use natural gas mixed with manufactured gas. The quantity of natural gas delivered to these consumers in 1948 was small, as deliveries did not begin until September.

California showed the largest increase in the volume of gas consumed by domestic installations—23,000 million cubic feet. This State also had the second-largest increase in number of consumers—149,600. These increases were made possible by completion of the Texas–California transmission line.

Commercial consumption of natural gas rose to 323,000 million cubic feet, and the number of consumers increased 106,000 to 1,145,000. Statewise the increases followed the same pattern as domestic consumption. Average consumption per meter increased from 274,000 cubic feet to 282,000.

Field.—Field use of natural gas increased 9 percent to 1,022,000 million cubic feet. In the post-World War II years, field use has, year by year, become a smaller percentage of marketed production, decreasing from 23 percent in 1945 to 20 percent in 1948 in spite of the increased field consumption entailed in gasoline-plant and cycle-plant operation. This trend probably reflects the more prudent use of natural gas in many fields as its value increased.

Carbon-Black Manufacture.—The consumption of natural gas in the manufacture of carbon black decreased in 1948 by 1 percent to 481,000 million cubic feet, the first decline since 1943. Declines took place in all reported States except New Mexico. The continued increase in consumption there can be attributed to the low average value of gas—

Domestic and commercial consumption of natural gas in the United States in 1948, by States [1]

State	Domestic				Commercial				Total			
	Number of consumers	Quantity (million cubic feet)	Value at point of consumption		Number of consumers	Quantity (million cubic feet)	Value at point of consumption		Number of consumers	Quantity (million cubic feet)	Value at point of consumption	
			Total (thousand dollars)	Average (cents per M)			Total (thousand dollars)	Average (cents per M)			Total (thousand dollars)	Average (cents per M)
Alabama	117,690	7,414	5,421	73.1	11,150	2,716	1,326	48.8	128,840	10,130	6,747	66.6
Arizona	80,210	4,267	3,324	77.9	10,250	3,449	1,316	38.2	90,460	7,716	4,640	60.1
Arkansas	129,830	13,763	6,666	48.4	19,690	6,743	2,390	35.4	149,520	20,506	9,056	44.2
California	2,336,110	157,327	96,309	61.2	203,820	70,875	27,961	39.5	2,539,930	228,202	124,270	54.5
Colorado	142,200	19,973	9,781	49.0	20,120	8,775	3,626	41.3	162,320	28,748	13,407	46.6
Florida	9,650	568	560	98.6	830	234	125	53.4	10,480	802	685	85.4
Georgia	135,200	11,972	8,006	66.9	14,000	5,569	2,061	37.0	149,200	17,541	10,067	57.4
Illinois	1,518,760	45,229	45,514	100.6	86,650	12,612	8,748	69.4	1,605,410	57,841	54,262	93.8
Indiana	315,550	14,377	14,747	102.6	19,550	3,921	3,219	82.1	335,100	18,298	17,966	98.2
Iowa	189,770	12,986	9,696	74.7	16,930	4,526	2,646	58.5	206,700	17,512	12,342	70.5
Kansas	305,590	34,081	16,435	48.2	38,240	17,405	5,831	33.5	343,830	51,486	22,266	43.2
Kentucky	220,680	18,416	10,029	54.5	24,190	5,548	2,603	46.9	244,880	23,964	12,632	52.7
Louisiana	323,530	21,235	12,685	59.7	35,420	12,879	3,813	29.6	358,950	34,114	16,498	48.4
Maryland, Virginia, and District of Columbia	274,600	12,828	16,503	128.6	19,960	2,869	3,029	105.6	294,560	15,697	19,532	124.4
Michigan	908,160	43,807	38,071	86.9	41,680	6,882	4,992	72.5	949,840	50,689	43,063	85.0
Minnesota	261,240	17,341	12,921	74.5	13,870	4,218	1,938	45.9	275,110	21,559	14,859	68.9
Mississippi	106,680	8,334	5,735	68.8	15,960	5,547	2,084	37.6	122,640	13,881	7,819	56.3
Missouri	495,260	30,389	20,253	66.6	42,680	9,626	4,189	43.5	537,930	40,015	24,442	61.1
Montana	61,280	10,661	4,907	46.0	6,040	6,365	1,951	30.7	67,320	17,026	6,858	40.3
Nebraska	155,210	13,788	9,616	69.7	13,500	6,236	2,622	42.0	168,710	20,024	12,238	61.1
New Mexico	59,450	5,580	3,554	63.7	6,980	4,431	1,438	32.5	66,430	10,011	4,992	49.9
New York	590,940	31,137	24,911	80.0	43,020	6,841	4,871	71.2	633,950	37,978	29,782	78.4
North Dakota, South Dakota, Utah, and Wisconsin	99,620	10,268	6,700	65.3	7,520	4,455	1,634	36.7	107,130	14,723	8,334	56.6
Ohio	1,613,110	125,485	77,287	61.6	136,650	28,693	16,171	56.4	1,749,760	154,178	93,458	60.6
Oklahoma	360,940	36,675	15,667	42.7	45,260	16,374	4,742	29.0	406,200	53,049	20,409	38.5
Pennsylvania	1,245,980	69,412	43,169	62.2	82,190	14,118	7,391	52.4	1,328,170	83,530	50,560	60.5
Tennessee	103,880	9,316	6,715	72.1	14,140	4,264	2,306	54.1	118,020	13,580	9,021	66.4
Texas	1,073,870	74,037	46,021	62.2	127,050	36,405	13,675	37.6	1,200,930	110,442	59,696	54.1
West Virginia	239,920	30,558	11,295	37.0	22,900	7,172	2,460	34.3	262,820	37,730	13,755	36.5
Wyoming	33,110	5,124	2,690	52.5	4,820	3,306	1,012	30.6	37,930	8,430	3,702	43.9
Total: 1948	13,508,010	896,348	585,188	65.3	1,145,060	323,054	142,170	44.0	14,653,070	1,219,402	727,358	59.6
1947	12,203,700	802,150	526,355	65.6	1,039,080	285,213	125,844	44.1	13,242,780	1,087,363	652,199	60.0

[1] Includes natural gas used with manufactured gas.

Industrial consumption of natural gas in the United States in 1948, by States and uses

State	Field (drilling, pumping, and operating gasoline-recovery plants)		Carbon-black manufacture			Fuel at petroleum refineries, electric public-utility power plants, cement plants, and other industrial						Total industrial			Fuel at electric public-utility power plants [1] (million cubic feet)
	Million cubic feet (estimated)	Value at point of consumption (estimated; thousand dollars)	Million cubic feet	Value at point of consumption		Million cubic feet				Value at point of consumption		Million cubic feet	Value at point of consumption		
				Total (thousand dollars)	Average (cents per M)	Petroleum refineries	Portland cement plants	Other industrial	Total	Total (thousand dollars)	Average (cents per M)		Total (thousand dollars)	Average (cents per M)	
Alabama						400	6,883	43,700	50,983	8,470	16.6	50,983	8,470	16.6	6,070
Arizona								27,267	27,267	5,939	21.8	27,267	5,939	21.8	9,022
Arkansas	17,223	887				9,371	(2)	[2] 65,575	74,946	6,286	8.4	92,169	7,173	7.8	11,587
California	132,445	15,189	(3)	(3)	(3)	73,623	14,477	[3] 168,868	[3] 256,968	[3] 67,426	[3] 26.2	389,413	82,615	21.2	61,178
Colorado	2,339	150				57	(2)	[2] 29,441	29,498	4,265	14.5	31,837	4,415	13.9	10,102
Florida	27	1						8,144	8,144	1,082	13.3	8,171	1,083	13.3	2,558
Georgia							(2)	[2] 30,011	30,011	5,637	18.8	30,011	5,637	18.8	14,974
Illinois	13,502	1,108				1,041		96,412	97,453	24,258	24.9	110,955	25,366	22.9	12,984
Indiana	169	14				1,010		31,297	32,307	9,846	30.5	32,476	9,860	30.4	2,953
Iowa							4,713	28,125	32,838	6,127	18.7	32,838	6,127	18.7	15,774
Kansas	20,791	1,427	(3)	(3)	(3)	11,217	8,549	[3] 107,850	[3] 127,616	[3] 16,591	[3] 13.0	148,407	18,018	12.1	28,778
Kentucky	4,362	795				100		12,931	13,031	3,799	29.2	17,393	4,594	26.4	
Louisiana	142,770	7,011	21,672	1,022	4.7	66,602	(2)	[3] 161,679	228,281	21,357	9.4	392,723	29,390	7.5	56,928
Maryland, Virginia, and District of Columbia								1,821	1,821	1,200	65.9	1,821	1,200	65.9	2
Michigan	2,032	318.				25		23,232	23,257	11,356	48.8	25,289	11,674	46.2	16
Minnesota								30,817	30,817	5,883	19.1	30,817	5,883	19.1	14,524
Mississippi	15,606	1,065				281		35,477	35,758	5,058	14.1	51,364	6,123	11.9	7,879
Missouri	70	13				670	(2)	[2] 50,128	50,798	10,914	21.5	50,868	10,927	21.5	11,241
Montana	1,948	168				1,829		12,116	13,945	1,986	14.2	15,893	2,154	13.6	828
Nebraska						51	(2)	[2] 27,572	27,623	4,862	17.6	27,623	4,862	17.6	11,973
New Mexico	32,644	949	42,616	1,566	3.7	995		23,866	24,861	3,474	14.0	100,121	5,989	6.0	10,795
New York	162	50				10		6,050	6,060	3,464	57.2	6,222	3,514	56.5	298
North Dakota, South Dakota, Utah, and Wisconsin						325	(4)	18,154	18,479	2,993	16.2	18,479	2,993	16.2	3,087
Ohio	1,132	272				1		80,826	80,827	32,480	40.2	81,959	32,752	40.0	1,414
Oklahoma	105,220	5,781	15,857	1,144	7.2	30,900	(2)	[2] 72,929	103,829	11,680	11.2	224,906	18,605	8.3	32,980
Pennsylvania	5,435	1,751				494		102,172	102,666	36,094	35.2	108,101	37,845	35.0	28
Tennessee								24,186	24,186	4,287	17.7	24,186	4,287	17.7	6,650

See footnotes at end of table.

Industrial consumption of natural gas in the United States in 1948, by States and uses—Continued

State	Field (drilling, pumping, and operating gasoline-recovery plants)		Carbon-black manufacture			Fuel at petroleum refineries, electric public-utility power plants, cement plants, and other industrial						Total industrial			Fuel at electric public-utility power plants [1] (million cubic feet)
	Million cubic feet (estimated)	Value at point of consumption (estimated; thousand dollars)	Million cubic feet	Value at point of consumption		Million cubic feet				Value at point of consumption		Million cubic feet	Value at point of consumption		
				Total (thousand dollars)	Average (cents per M)	Petroleum refineries	Portland cement plants	Other industrial	Total	Total (thousand dollars)	Average (cents per M)		Total (thousand dollars)	Average (cents per M)	
Texas	494,330	20,031	381,451	17,990	4.7	234,019	20,859	364,854	619,732	50,201	8.1	1,495,513	88,222	5.9	142,015
West Virginia	17,085	3,425				1,784		55,503	57,287	14,844	25.9	74,972	18,269	24.4	413
Wyoming	11,621	718				6,665		4,084	11,349	1,497	13.2	22,970	2,215	9.6	1,046
Unclassified by States			[3] 19,050	[3] 1,001	[3] 5.3		[2] 16,658								
Total: 1948	1,021,513	61,123	480,646	22,723	4.7	441,470	72,139	1,709,979	2,223,588	382,355	17.2	3,725,747	466,201	12.5	478,097
1947	933,761	49,835	484,882	17,316	3.6	363,892	60,499	1,496,147	1,920,538	308,968	16.1	3,339,181	376,119	11.3	373,037

[1] Federal Power Commission. These figures include some manufactured gas and are therefore shown separately. The natural gas component in these figures is included with "Other Industrial."

[2] Gas used in portland-cement plants included under "Unclassified by States," for United States total and under "Other industrial" for State total to avoid disclosing figures of individual operators.

[3] Gas used in carbon-black manufacture included under "Unclassified by States' for United States total and under "Other industrial" for State total to avoid disclosing figures of individual operators.

[4] Less than 500 M cubic feet.

3.7 cents per thousand cubic feet. The national average value of gas consumed by carbon-black plants in 1948 was 4.7 cents per thousand cubic feet compared with 3.6 cents in 1947. Further details of the carbon-black industry appear in the Carbon Black chapter.

Petroleum Refineries.—The use of natural gas as fuel at petroleum refineries increased 21 percent in 1948 to 441,000 million cubic feet. It continues to increase in importance as a refinery fuel, constituting 34 percent of all such fuel in 1948. Refineries in Texas consume over half of the total amount used, and 85 percent is consumed in Texas, California, and Louisiana.

Electric Public-Utility Power Plants.—Gas consumption by electric public-utility power plants, as reported by the Federal Power Commission, increased in 1948 by 28 percent to 478,000 million cubic feet. A small amount of manufactured gas is included in this figure. Texas and California showed the greatest increases in consumption. Easing of the gas shortage with completion of the Texas-California pipeline made this possible in California. Large gains were also made in Arizona, Illinois, Iowa, Louisiana, and Minnesota. Of the States that used over 1 billion cubic feet per year, only Alabama, Florida, and Tennessee showed decreases.

Portland-Cement Plants.—Production of portland cement in 1948 increased 10 percent, while at the same time the use of natural gas as fuel at these plants increased 19 percent to 72,000 million cubic feet. This reflects the better availability of gas in 1948, as production of portland cement in 1947 increased 14 percent while gas consumption increased only 4 percent.

Other Industrial.—The consumption of natural gas by all industry other than those individually mentioned increased 14 percent to 1,710,000 million cubic feet. The largest increase—60,000 million cubic feet—took place in Texas, followed by Illinois, Oklahoma, and California. Illinois, Indiana, and Missouri, which lost industrial consumption in 1947, more than regained this loss in 1948 as a result of the increased throughputs of the Panhandle Eastern Pipeline Co. and the Texas Eastern Transmission Co. pipelines. Of the States that lost industrial consumption, Michigan, Wisconsin, and New York will no doubt regain this consumption when transmission lines now under construction to these markets are completed in 1949 and 1950.

The Bureau of the Census published a detailed break-down of fuel consumption by industry for 1947. This census did not include "Carbon-black manfacture," "Electric public-utility power plants," and most of the "Field" uses, which categories are included under "Industrial" by the Bureau of Mines.

Mixed Gas.—The over-all rise in the number of consumers of mixed gas was due to the large gains made in Pennsylvania. Completion of natural-gas lines to Philadelphia resulted in this city's conversion from manufactured gas to mixed gas. The District of Columbia converted from mixed gas to straight natural gas in 1947. Minnesota, Nebraska, and Ohio showed large decreases in the number of mixed-gas consumers. The total volume of mixed gas consumed in 1948 decreased by 9 percent to 114,000 million cubic feet. The quantity of mixed gas consumed usually will increase when natural gas is first made available to a locality and subsequently diminish as the natural gas entirely replaces manufactured gas.

Consumption of natural gas used with manufactured gas in the United States in 1948, by States

State	Domestic		Commercial		Industrial (million cubic feet)	Total	
	Number of consumers	Million cubic feet	Number of consumers	Million cubic feet		Million cubic feet	Value at point of consumption (thousands of dollars)
Illinois	1,059,290	26,362	53,350	7,638	12,810	46,810	33,852
Indiana	95,660	3,441	4,650	869	3,816	8,126	6,424
Iowa	23,020	539	2,200	173	62	774	748
Kentucky	92,640	5,352	8,060	2,186	2,134	9,672	4,989
Michigan	5,290	106	210	20	34	160	180
Minnesota	79,640	256	3,310	48	46	350	334
Missouri	286,060	8,521	11,320	1,436	2,145	12,102	10,440
Nebraska	1,290	37	120	11	----------	48	44
New York	437,880	17,014	26,730	3,265	3,233	23,512	18,057
Ohio	180,790	2,966	18,650	1,030	566	4,562	2,883
Pennsylvania	534,690	6,186	31,530	1,040	1,001	8,227	5,784
Tennessee	1,380	16	120	10	----------	26	48
Virginia	780	10	180	19	----------	29	44
Total: 1948	2,798,410	70,806	160,430	17,745	25,847	114,398	83,827
1947	2,719,800	83,239	155,320	18,923	22,103	124,265	90,932

PRICES

The average value at wells for natural gas rose in 1948 to 6.5 cents per thousand cubic feet from 6.0 cents per thousand in 1947. The increase in price in Texas was greater than the average—from 3.7 to 4.5 cents per thousand cubic feet. New Mexico still has the lowest wellhead price—2.7 cents per thousand cubic feet. Of the three largest producers in the Southwest—Texas, Oklahoma, and Louisiana—the price of gas in Louisiana at 3.9 cents per thousand cubic feet is now the lowest.

The price of natural gas to domestic consumers declined an average of 0.3 cent per thousand cubic feet to 65.3 cents. The declines were general in all areas except the East and Great Lakes regions.

The average value at point of consumption of gas sold to industry, including petroleum refineries and portland-cement plants, rose from 16.1 cents per thousand cubic feet in 1947 to 17.2 cents in 1948. Large [illegible]

District of Columbia). The increase in Texas nullified the 1947 decline. Price declines in Illinois and Indiana following the 1947 increases indicate the better supply position in these States.

Data on the average values of natural gas at wells and at points of consumption, by individual States and by uses, in 1948 are tabulated in the Marketed Production and in the Consumption sections of this chapter.

TECHNOLOGY

The majority of technical developments within the industry are aimed at alleviating or eliminating the seasonal load variation. The Federal Power Commission has granted one company in the Chicago

area permission to construct a plant to produce and store liquefied natural gas. It will have a storage capacity of 400,000 million cubic feet. Another approach to peak load relief is the standby oil-gas generator. A so-called "push-button" unit is being tested, which will have a short start-up and shut-down time and be able to produce continuously; it will feature silicon carbide cracking tubes permitting higher operating temperatures.

In the appliance industry the peak-load problem is being attacked by the introduction of combination gas-oil burners that would burn gas under normal conditions but could switch to oil during high demand periods.

Improvements in the gas turbine, which is now reported to have a thermal efficiency of 30 percent, have prompted one pipeline operator to order an experimental unit to drive a centrifugal compressor at a pipeline compressor station.

WORLD REVIEW

By comparison, natural-gas utilization outside the United States is very small. Large producing fields have usually been in sparsely populated regions. Austria, Czechoslovakia, Hungary, Poland, Rumania, and the U. S. S. R. have for many years marketed natural gas. The U. S. S. R. is reported to have recently completed several transmission pipelines. News of recent developments in these countries is very sketchy. Germany has only one producing gas field, Bentheim. Its production is consumed by a chemical plant. Great Britain's small production, too, is used industrially. The South American oil-producing countries have made local use of their natural gas for both domestic and industrial purposes.

With the proved practicality of long-distance pipeline transmission, interest is growing in foreign countries in more extensive marketing of natural gas.

Argentina.—Natural gas consumption in Argentina in 1948 was 8.2 billion cubic feet, an increase of 23 percent over the previous year. In September of 1949 construction was completed on an 1,100-mile, 10-inch line from the Comodoro Rivadavia fields to Buenos Aires. Plans have been made to tie the Plaza Huincul fields into this line by constructing a 500-mile, 8-inch line to General Conesa.

Canada.—Production of natural gas in Canada in 1949 was 74.9 billion cubic feet, 78 percent over 1948. Nearly 90 percent of this was produced in Alberta Province. Gas reserves of Alberta were estimated to be about 4 trillion cubic feet at the end of 1948. This estimate did not include the considerable reserves of the Pincher Creek field. Several proposals have been made for pipelines to transport gas to other Provinces and to the Pacific Northwest States. No authorizations will be granted until the Provincial Government is convinced that the future requirements of Alberta will not be jeopardized by such exports.

France.—In 1949 France completed a 114-mile pipeline from Toulouse to Bordeaux to supply 12 million cubic feet of gas per day from the St. Marcet field.

Consumption of natural gas, by countries, 1940 and 1944–48, in million cubic meters

[United Nations Statistical Yearbook]

Country	1940	1944	1945	1946	1947	1948 [1]
Western Hemisphere:						
Argentina	536	662	609	562	(2)	(2)
Canada	1,168	1,276	1,371	1,385	1,491	1,604
Ecuador	59	64	70	66	87	(2)
Mexico	1,141	729	762	768	997	1,066
United States	75,332	105,089	110,969	114,138	125,864	138,000
Venezuela	3,330	5,089	7,257	9,381	11,402	13,319
Europe:						
Austria	(2)	149	(2)	(2)	(2)	(2)
Czechoslovakia	2	1	2	3	(2)	(2)
Denmark	(2)	4	4	3	3	(2)
France	(2)	66	85	110	148	175
Germany [4]	(2)	59	71	109	78	67
Hungary	32	78	77	91	101	(2)
Italy	28	49	42	64	93	108
Poland	(2)	(2)	(2)	149	148	(2)
Rumania	(2)	930	1,304	1,332	[1] 1,176	(2)
Yugoslavia	(2)	(2)	3	6	12	(2)
Asia:						
Brunei	147	(2)	(2)	[1] 28	253	(2)
China [5]	(2)	60	(2)	61	55	(2)
Indonesia	1,014	(2)	(2)	(2)	(2)	(2)
Japan	(2)	42	39	(2)	(2)	(2)
Total [6]	85,000	115,000	123,000	129,000	143,000	157,000

[1] Preliminary figures.
[2] Data not available.
[3] Less than 500.000 cubic meters.
[4] American-British Zones.
[5] Beginning 1945, industries under control of National Resources Commission.
[6] Excluding USSR, where natural-gas consumption was last reported as 1,400 million cubic meters in 1936.

Japan.—Since the end of World War II, Japan has developed the gas resources on the Chiba Peninsula near Tokyo. Proved reserves at the end of 1949 were 560 billion cubic feet. The operators of the field hope to construct a 12-inch pipeline to Tokyo to supply this and neighboring cities with 10 million cubic feet of gas per day. The fuel shortage in Japan has been so acute that compressed natural gas is being used as motorcar fuel.

Mexico.—In 1949 Mexico produced about 41 billion cubic feet of natural gas. Over 75 percent of this was produced in the Tuxpan area. Recent discoveries in the northeastern part of the country in the Reynasa, Cana, Brazil, and 18 de Marzo fields promise to hold larger gas reserves than have been proved anywhere in the country. It is possible that production from these fields may supplant gas now being exported from Texas for use in the Monterrey area of Mexico.

A 20-inch pipeline was completed in 1949 from Poza Rica to Mexico City. The gas will be entirely for industrial use. Pipelines from Monterrey to Torreon and from Reynasa to Mexico City are in the planning stages.

Natural Gasoline

and Liquefied Petroleum Gases[1]

By G. W. Cale, E. M. Seeley, A. T. Coumbe, and I. F. Avery

GENERAL SUMMARY

COMBINED production of natural-gas liquids in 1949 totaled 6,561 million gallons, an increase of 6 percent over the preceding year and another record. The gain was maintained consistently throughout the year, as each quarter recorded an increment over the comparable 1948 quarter.

The average yield of all light products was 1.39 gallons per thousand cubic feet of gas processed in 1949, a slight decrease from the preceding year. The yield of natural gasoline dropped to 0.64 gallon, and the recovery of LP-gases[2] was 0.51 gallon per thousand cubic feet. The production of propane gained 12 percent and butane 31 percent compared with 1948. Natural gasoline continued to be the most valuable of all products processed; LP-gases held second place, and other products were last.

Notwithstanding a 46-percent reduction in the total number of plants during the past 20 years, the over-all plant capacity has nearly trebled during this period. The industry has followed an expansion program which included enlarging existing facilities during 1949, resulting in a tremendous increase in capacity, especially at cycle plants. The total daily capacity of all natural-gasoline plants totaled 20.6 million gallons and cycle plants 6.6 million gallons.

The trend toward extraction of higher propane yields has been accelerated by installation of refrigeration and other equipment in many plants.

A new development that may have far-reaching significance in future is the underground storage of surplus LP-gases during the summer months. This practice has now advanced beyond the experimental stage, and several companies have utilized salt-water sands in storing surplus products. This procedure assures an adequate supply of LP-gases during the winter months and in addition acts as a conservation program, as it is unnecessary to burn excess products during the slack season. Another benefit is the large saving effected in utilizing underground storage rather than erecting specially designed pressure storage tanks.

Noteworthy is the recent development of upgrading the cycle-plant gasoline octane number at central plants and increasing the volume of finished gasoline and naphtha processed at the plants. Of special interest is the report that some cycle plants have already installed small catalytic reformer units to manufacture finished motor fuel.

The total demand for natural-gas liquids processed at natural-gasoline and cycle plants was 6,706 million gallons, an increase of 6.7 per-

[1] Data for 1949 preliminary.
[2] Liquefied petroleum gases.

Salient statistics of the natural-gasoline industry in the United States, 1945–49, in thousands of gallons

	1945	1946	1947	1948	1949 [1]
Production:					
Natural gasoline and natural-gasoline mixtures	2,498,741	2,691,001	2,743,731	2,979,412	3,007,528
LP-gases:					
Isobutane	162,756	164,015	206,184	196,354	175,301
Other LP-gases	1,250,468	1,245,330	1,685,634	2,012,717	2,243,135
Finished gasoline and naphtha	334,957	355,113	431,743	528,935	663,981
Other products	457,251	405,574	483,975	444,869	470,601
Total	4,704,173	4,861,033	5,551,267	6,162,287	6,560,546
Receipts from outside sources	120,074	118,850	122,705	172,333	181,264
Stock change at plants and terminals	+24,139	+33,996	−26,481	+49,924	+35,714
Total supply	4,800,108	4,945,887	5,700,453	6,284,696	6,706,096
Shipments to refineries:					
Natural gasoline and natural-gasoline mixtures	2,384,216	2,438,416	2,554,494	2,757,680	2,770,418
LP-gases	657,018	381,175	407,206	431,926	513,162
Other products	496,895	412,905	477,001	491,015	481,380
Shipments to jobbers and trade outlets:					
Natural gasoline	94,155	157,523	177,848	172,579	183,554
For fuel	668,698	860,619	1,212,648	1,495,588	1,621,107
For chemical manufacture	170,386	209,394	242,280	285,165	285,314
Finished gasoline and naphtha	229,948	265,819	361,182	371,333	505,323
Condensate	6,511	11,205	7,131	8,407	8,850
Transfers of cycle products	35,658	52,990	71,576	80,402	103,747
Exports from plants	31,453	121,781	156,114	153,238	171,684
Losses	25,170	34,060	32,973	37,363	61,557
Total demand at plants and terminals	4,800,108	4,945,887	5,700,453	6,284,696	6,706,096
Stocks at plants, terminals, and refineries:					
Natural gasoline	101,726	138,667	118,346	151,571	172,207
LP-gases	39,517	32,264	30,225	44,147	49,228
Other products	40,270	38,278	31,847	38,614	65,453
Total	181,513	209,209	180,418	234,332	286,888
Value at plants:					
Natural gasoline ... thousands of dollars	112,018	111,798	171,057	257,125	193,217
LP-gases ... do	41,994	36,079	66,820	117,823	98,464
Finished gasoline and naphtha ... do	33,552	34,404	57,117	52,414	51,677
Other products ... do				31,615	28,792
Average per gallon ... cents	4.0	3.7	5.3	7.4	5.7
Natural gas treated ... millions of cubic feet	3,653,870	3,663,760	4,070,150	4,393,500	4,710,540
Average yield, light products except LP-gases per M cubic feet ... gallons	0.90	0.94	0.90	0.90	0.88
Average yield, all light products ... do	1.29	1.33	1.36	1.40	1.39
Sales to consumers for fuel and chemical uses:					
LP-gases	839,084	1,039,688	1,448,807	1,766,017	1,901,149
LR-gases [2]	437,682	664,574	760,990	970,784	935,450
Total	1,276,766	1,704,262	2,209,797	2,736,801	2,836,599
Exports of natural gasoline and LP-gases	62,971	177,875	256,160	216,294	236,650

[1] Preliminary figures.
[2] Liquefied refinery gases.

cent compared with 1948. Shipments of light hydrocarbons to refineries totaled 3,765 million gallons, equivalent to 56 percent of the total demand in 1949, compared with 59 percent in 1948. It is evident that the sales of light liquid products to refineries are becoming less important each year, relative to total output of the industry.

Sales of natural gasoline to jobbers and other trade outlets increased 6 percent in 1949 compared with the previous year, while sales of finished gasoline and naphtha rose 36 percent. Stocks of light hydrocarbons were 287 million gallons at the year's end, a 22-percent increase over the closing inventory of 1948.

The total value of all natural-gas liquids at plants declined to $372,150,000 in 1949, a drop of 19 percent compared with the preceding year. This monetary loss was directly attributable to the sharp break in the market as evidenced by lower prices for products in all areas. The average value declined from 7.4 cents per gallon in 1948 to 5.7 cents in 1949. The average price of 26–70 natural gasoline in 1949 was 5.8948 cents per gallon f. o. b. group 3 basis, a decline of 31 percent from the preceding year. Likewise, the average price of this product f. o. b. Breckenridge dropped 33 percent. A break occurred in LP-gas prices throughout the country in 1949 because a surplus of this material was made available in the principal consuming areas. The drop was unusually severe in the New York Harbor area, where the average price for commercial propane decreased 2.5 cents per gallon.

Export shipments totaled 237 million gallons, a gain of 21 million gallons compared with 1948. The largest importer of United States natural gasoline was Canada, while the United Kingdom was second and the Netherlands Antilles third. Canada also led in LP-gas imports, Mexico took second place, and Brazil was next in importance.

RESERVES

Reserves of natural-gas liquids totaled 3,729,012,000 barrels as of December 31, 1949, according to a report of the American Gas Association and the American Petroleum Institute. This estimate includes condensate, natural gasoline, and LP-gases and represents an increase of 188,229,000 barrels over 1948.

Estimated proved recoverable reserves of natural-gas liquids [1] in the United States, 1948–49, in thousands of barrels

[Committee on Natural Gas Reserves, American Gas Association]

State	Reserves as of Dec. 31, 1948	Changes in reserves during 1949			Reserves as of Dec. 31, 1949			
		Extensions and revisions	Discoveries of new fields and new pools in old fields	Net production	Nonassociated	Associated	Dissolved	Total
Arkansas	57,457	1,149	128	3,092	35,338	7,865	12,439	55,642
California	307,908	29,996	9,560	27,189		108,564	211,711	320,275
Colorado	36,299	−5,307	25	6,827	906		23,284	24,190
Illinois	24,162	6,238	81	3,815	28	75	26,563	26,666
Indiana	108	29	20	31	25		101	126
Kansas	102,344	6,573	113	2,625	102,612	1,491	2,302	106,405
Kentucky	14,401	315	157	1,628	13,245			13,245
Louisiana	524,096	81,174	17,821	26,669	447,929	99,122	49,371	596,422
Michigan	1,066	238	18	119	728		475	1,203
Mississippi	57,564	1,440	101	2,698	24,173	25,945	6,289	56,407
Montana	4,000	−80	20	230	3,545	30	135	3,710
New Mexico	80,247	9,152	736	4,416	24,523	38,889	22,307	85,719
Ohio	1,664	119	13	126	[2] 1,670			1,670
Oklahoma	200,388	43,062	7,952	17,372	103,063	21,900	109,067	234,030
Pennsylvania	2,645	158	79	239	[2] 2,643			2,643
Texas	2,074,674	110,442	54,794	96,199	1,303,100	323,898	516,713	2,143,711
Utah	209	7	2	10	206		2	208
West Virginia	15,214	1,107	369	3,859	[2] 12,831			12,831
Wyoming	36,307	8,416	540	1,400	28,055	2,979	12,829	43,863
Alabama, Florida, Maryland, Missouri, Nebraska, New York, Virginia	30	−17	36	3		33	13	46
Total	3,540,783	294,211	92,565	198,547	2,104,620	630,791	993,601	3,729,012

[1] Comprises natural gasoline, LP-gases, and condensate.
[2] Not allocated by types, but occurring principally in column shown.

Largest increases in reserves were reported by the following States (in millions of barrels): Louisiana 72, Texas 69, Oklahoma 34, California 12, Wyoming 8, and New Mexico 5. States reporting the biggest declines were: Colorado 12, West Virginia 2, and Kentucky and Mississippi 1 each.

Estimated reserves of natural gas were 180,381,344 million cubic feet on December 31, 1949, an increase of 6,512,004 million cubic feet compared with reserves on December 31, 1948. The comparable reserves of 3,729,012,000 barrels of natural-gas liquids would therefore indicate an average yield of 0.87 gallon per thousand cubic feet of gas reserves.

PRODUCTION

Production of natural gasoline and allied products continued to shatter all previous records, with an output of 6,560,546 thousand gallons—a 6-percent increment over 1948. Commencing in January 1949 and continuing throughout the year, production of light hydrocarbons each month surpassed the output of the comparable 1948 month.

The 1949 production of natural gasoline totaled 3,007,528 thousand gallons, a 1-percent increase over the preceding year, whereas LP-gases gained over 9 percent, with a production of 2,418,436 thousand gallons. The largest increase was made by finished gasoline and other light products, with an output of 1,134,582 thousand gallons, a gain of almost 17 percent in comparison with 1948.

Texas produced almost 50 percent of the Nation's output of light products in 1949, while California was second with 17 percent and Louisiana third with 12 percent.

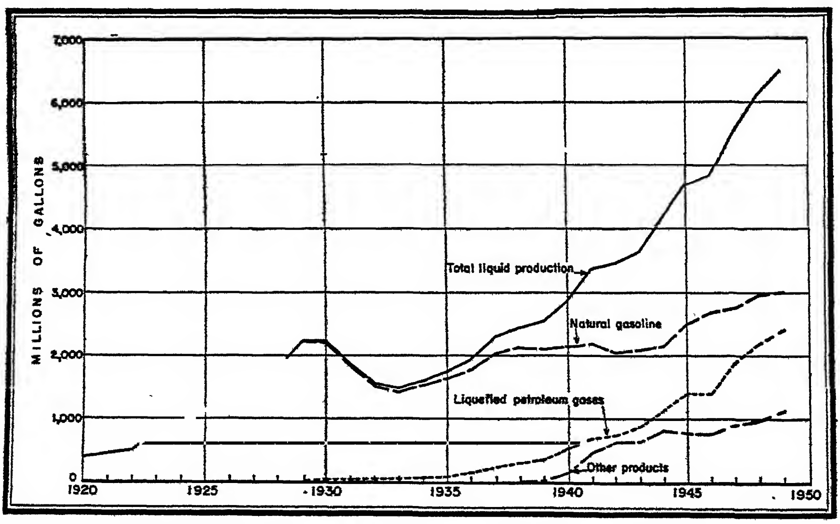

FIGURE 1.—Production of the natural-gasoline industry, 1920–49.

Natural gasoline and allied products produced and natural gas treated in the United States, 1948–49, by States

State	Number of operators[2]	Production										Natural gas treated		
		Natural gasoline		LP-gases		Finished gasoline and naphtha		Other products[1]		Total		Million cubic feet	Average yield (gallons per M cubic feet)	
		Thousand gallons	Thousand dollars	Thousand gallons	Thousand dollars	Thousand gallons	Thousand dollars	Thousand gallons	Thousand dollars	Thousand gallons	Thousand dollars		Light products except LP-gases	All light products
1948														
Arkansas	8	52,188	4,913	36,570	2,021	3,550	370	2,547	171	94,855	7,475	60,265	0.97	1.57
California	30	707,414	53,335	270,103	16,527			137,547	9,499	1,115,064	79,361	474,607	1.78	2.35
Colorado	1	1,200	120	206	12					1,406	132	364	3.30	3.86
Illinois	8	45,553	5,575	103,074	7,851					148,627	13,426	19,545	2.33	7.60
Kansas	9	77,567	6,561	29,996	1,716					107,563	8,277	230,119	.34	.47
Kentucky	3	10,025	938	55,737	1,683					65,762	2,621	44,748	.22	1.47
Louisiana	24	330,585	29,077	182,218	11,346	80,322	8,847	116,713	8,629	709,838	57,899	405,101	1.30	1.75
Michigan	2	2,537	246	46	3					2,583	249	1,586	1.60	1.63
Mississippi	1	27,159	1,687	18,133	922			1,885	128	47,177	2,737	32,325	.90	1.46
Montana	1	3,402	370	5,045	350					8,447	720	13,615	.25	.62
New Mexico	7	99,871	9,099	30,286	1,858			181	12	130,338	10,469	177,191	.56	.74
New York	1	13	1							13	1	12	1.08	1.08
Ohio	5	5,435	561	211	11	652	68			6,298	640	24,366	.25	.26
Oklahoma	39	267,252	25,401	196,581	10,963	5,645	742			469,478	37,106	266,479	1.02	1.76
Pennsylvania	15	11,280	1,110	919	67	39	6			12,238	1,183	37,289	.30	.33
Texas	86	1,254,542	109,807	1,154,228	57,770	435,166	42,035	184,916	13,106	3,028,852	222,718	2,382,804	.79	1.27
Utah		576	61							576	61			
West Virginia	15	46,939	4,450	101,173	3,675	3,561	346	1,080	70	152,763	8,541	193,086	.27	.79
Wyoming	5	35,874	3,813	24,545	1,548					60,419	5,361	29,998	1.20	2.01
Total	211	2,979,412	257,125	2,209,071	117,823	528,935	52,414	444,869	31,615	6,162,287	458,977	4,393,500	.90	1.40

See footnotes at end of table.

Natural gasoline and allied products produced and natural gas treated in the United States, 1948–49, by States—Continued

State	Number of operators [2]	Production										Natural gas treated		
		Natural gasoline		LP-gases		Finished gasoline and naphtha		Other products [1]		Total		Million cubic feet	Average yield (gallons per M cubic feet)	
		Thousand gallons	Thousand dollars	Thousand gallons	Thousand dollars	Thousand gallons	Thousand dollars	Thousand gallons	Thousand dollars	Thousand gallons	Thousand dollars		Light products except LP-gases	All light products
1949 [3]														
Arkansas	8	52,662	3,254	37,962	1,473	2,530	157	2,328	140	95,472	5,024	59,995	0.96	1.59
California	30	732,257	57,995	275,318	19,080	150	12	129,736	7,820	1,137,461	84,907	493,272	1.75	2.31
Colorado	1	6,289	475	5,792	300					12,081	775	5,551	1.13	2.18
Illinois	8	39,157	2,753	97,379	4,655					136,536	7,408	18,303	2.14	7.46
Kansas	10	79,865	4,580	32,430	1,119					112,295	5,699	262,711	.30	.43
Kentucky	3	8,671	617	59,865	1,598					68,536	2,215	47,335	.18	1.45
Louisiana	25	326,458	18,510	204,662	6,959	110,272	10,862	122,506	6,787	763,898	43,118	443,680	1.26	1.72
Michigan	3	3,229	216							3,229	216	1,487	2.17	2.17
Mississippi	1	29,578	2,062	20,671	558			46	3	50,295	2,623	38,365	.77	1.31
Montana	1	3,601	272	6,123	317					9,724	589	13,796	.26	.70
New Mexico	9	114,372	7,789	54,315	2,113			35	2	168,722	9,904	175,019	.65	.96
New York	1	9	1							9	1	22	.41	.41
Ohio	4	4,819	404			451	38			5,270	442	20,648	.26	.26
Oklahoma	38	280,695	17,712	238,939	7,909	10,108	647	197	13	529,939	26,281	283,001	1.03	1.87
Pennsylvania	15	9,554	692	698	45	12	1			10,264	738	34,969	.27	.29
Texas	92	1,236,477	70,108	1,250,604	47,898	538,153	39,770	214,780	13,961	3,240,014	171,737	2,584,738	.77	1.25
Utah		616	47							616	47			
West Virginia	13	42,070	2,924	117,774	3,616	2,305	190	639	39	162,788	6,769	195,361	.23	.83
Wyoming	5	37,159	2,806	15,904	824			334	27	53,397	3,657	32,287	1.16	1.65
Total	210	3,007,528	193,217	2,418,436	98,464	663,981	51,677	470,601	28,792	6,560,546	372,150	4,710,540	.88	1.39

[1] Includes condensate, kerosine, distillate fuel, etc.
[2] A producer operating in more than 1 State is counted but once in arriving at total for United States.
[3] Preliminary figures.

REVIEW BY STATES

California.—In California production of all light products totaled 1,137,461 thousand gallons in 1949, an increase of 2 percent over the preceding year. Output of natural gasoline gained 3.5 percent, while LP-gases increased 2 percent in contrast with 1948.

Louisiana.—The total production of light hydrocarbons in 1949 was 763,898 thousand gallons, which represented an increment of 8 percent in comparison with the previous year's production. Output of natural gasoline declined approximately 1 percent but production of LP-gases gained 12 percent, and finished gasoline and naphtha rose 37 percent. Production of light products in the Gulf Coast area continued to decline moderately, but output in Louisiana Inland gained 16 percent compared with 1948.

Oklahoma.—The combined production of natural-gas liquids continued the upward trend of recent years increasing 13 percent to a record output of 529,939 thousand gallons in 1949. Finished gasoline and naphtha jumped 79 percent, while LP-gases rose 22 percent and natural gasoline increased 5 percent in 1949.

Monthly production of natural gasoline and allied products in the United States, 1948–49, by States and districts, in millions of gallons

Field	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1948													
West New York and west Pennsylvania	1.3	1.2	1.1	1.1	1.1	0.9	0.8	0.8	0.8	1.0	1.0	1.1	12.2
West Virginia	13.5	12.8	14.4	13.4	13.1	11.0	11.0	11.2	11.6	13.5	13.6	13.7	152.8
Ohio	.6	.6	.6	.5	.5	.5	.5	.5	.5	.5	.5	.5	6.3
Illinois	12.5	11.0	12.3	12.1	13.0	12.4	12.4	12.2	12.6	13.1	12.6	12.4	148.6
Kentucky	5.9	5.5	5.8	5.3	5.7	4.9	4.7	4.8	4.8	5.9	5.7	6.8	65.8
Michigan	.2	.2	.2	.3	.3	.2	.2	.2	.2	.2	.2	.2	2.6
Kansas	10.1	9.9	9.7	9.0	8.6	8.1	8.0	8.1	7.8	8.8	9.4	10.1	107.6
Oklahoma	38.3	36.9	40.1	37.3	36.9	34.9	36.7	38.0	39.1	42.3	43.0	46.0	469.5
Texas:													
Gulf	66.0	61.5	67.5	65.8	65.1	61.6	63.2	66.7	67.1	71.6	71.9	73.1	801.1
East Texas	30.4	30.3	34.3	32.9	33.9	34.1	34.4	36.3	36.1	36.7	33.8	32.5	405.7
Panhandle	60.9	56.8	57.4	56.8	57.3	49.1	47.0	52.3	53.6	61.6	62.2	67.2	682.2
Rest of State	86.3	82.5	86.6	87.1	90.6	94.7	98.8	99.8	99.2	102.4	104.4	107.4	1,139.8
Total Texas	243.6	231.1	245.8	242.6	246.9	239.5	243.4	255.1	256.0	272.3	272.3	280.2	3,028.8
Arkansas	8.5	8.0	8.4	7.2	7.5	6.9	7.6	7.5	8.0	8.1	8.4	8.8	94.9
Louisiana:													
Gulf	28.7	28.2	29.0	26.8	29.7	27.7	30.4	27.5	27.5	30.8	27.9	28.8	343.0
Inland	26.6	23.2	32.8	27.4	30.1	28.4	30.7	31.4	30.9	35.5	33.4	36.4	366.8
Total Louisiana	55.3	51.4	61.8	54.2	59.8	56.1	61.1	58.9	58.4	66.3	61.3	65.2	709.8
Mississippi	4.0	3.7	4.1	3.9	3.7	3.3	3.8	3.9	4.0	4.2	4.2	4.4	47.2
New Mexico	8.7	8.3	9.5	10.1	10.7	10.9	11.0	11.5	12.3	12.4	12.0	12.9	130.3
Montana	.8	.7	.8	.7	.6	.6	.4	.5	.6	.7	.9	1.1	8.4
Colorado, Utah, Wyoming	6.3	6.0	5.8	4.6	4.6	4.3	4.5	4.9	5.1	5.5	5.4	5.4	62.4
California	98.7	93.3	99.3	92.4	97.3	93.7	95.7	95.7	66.1	87.4	95.1	100.4	1,115.1
Total United States	508.3	480.6	519.7	494.7	510.3	488.2	501.8	513.8	487.9	542.2	545.6	569.2	6,162.3
Daily average	16.4	16.6	16.8	16.5	16.5	16.3	16.2	16.6	16.3	17.5	18.2	18.4	16.8

Monthly production of natural gasoline and allied products in the United States, 1948–49, by States and districts, in millions of gallons—Continued

Field	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1949 [1]													
West New York and west Pennsylvania	1.1	.9	1.0	.8	.8	.8	.6	.7	.6	.7	1.1	1.2	10.3
West Virginia	13.8	13.5	14.6	14.1	14.0	12.3	11.4	11.8	13.5	13.5	14.8	15.5	162.8
Ohio	.5	.5	.5	.4	.4	.3	.3	.4	.5	.5	.5	.5	5.3
Illinois	12.2	10.6	11.7	11.3	10.8	10.6	11.3	11.7	11.5	12.0	11.4	11.4	136.5
Kentucky	6.4	5.4	5.8	5.6	5.0	4.6	5.0	5.6	5.8	6.5	6.3	6.5	68.5
Michigan	.2	.1	.2	.3	.3	.3	.3	.3	.3	.3	.3	.3	3.2
Kansas	9.4	8.5	8.7	8.9	8.1	7.8	7.5	8.2	9.5	11.4	12.1	12.2	112.3
Oklahoma	43.7	39.4	41.5	39.2	40.9	38.2	43.4	45.5	47.1	50.1	49.6	51.3	529.9
Texas:													
Gulf	72.2	64.4	70.5	68.0	68.1	65.1	70.4	77.8	78.9	81.5	83.5	84.0	884.4
East Texas	30.4	31.0	29.7	25.8	28.3	27.4	26.0	27.3	28.0	30.3	31.4	28.9	344.5
Panhandle	50.8	52.6	51.6	50.9	52.2	44.6	47.8	50.7	49.8	55.2	58.0	64.3	628.5
Rest of State	107.4	100.2	109.0	106.5	106.6	106.8	111.3	116.5	123.3	125.8	131.3	137.9	1,382.6
Total Texas	260.8	248.2	260.8	251.2	255.2	243.9	255.5	272.3	280.0	292.8	304.2	315.1	3,240.0
Arkansas	8.7	8.0	8.3	8.1	7.9	7.1	7.2	7.0	7.4	8.2	8.7	8.9	95.5
Louisiana:													
Gulf	31.0	25.7	29.3	28.4	29.6	28.0	26.9	28.8	25.9	28.2	29.1	26.4	337.3
Inland	37.5	33.4	34.6	33.1	32.4	33.2	34.9	35.7	35.6	37.3	37.6	41.3	426.6
Total Louisiana	68.5	59.1	63.9	61.5	62.0	61.2	61.8	64.5	61.5	65.5	66.7	67.7	763.9
Mississippi	4.4	3.8	3.8	4.1	4.0	3.8	4.1	4.3	4.1	4.7	4.5	4.7	50.3
New Mexico	11.9	11.8	12.9	12.0	12.5	13.4	14.3	14.6	15.5	16.2	16.7	16.9	168.7
Montana	1.1	1.0	1.0	.7	.7	.6	.6	.5	.7	.9	.8	1.1	9.7
Colorado, Wyoming	4.6	4.3	4.9	5.2	5.2	5.1	6.0	6.0	5.9	6.4	6.5	6.0	66.1
California	98.2	91.8	96.8	94.6	95.7	92.1	94.4	94.4	93.0	95.6	93.6	97.3	1,137.5
Total United States	545.5	506.9	536.4	518.0	523.5	502.1	523.7	547.8	556.9	585.3	597.8	616.6	6,560.5
Daily average	17.6	18.1	17.3	17.3	16.9	16.7	16.9	17.7	18.6	18.9	19.9	19.9	18.0

[1] Preliminary figures.

Texas.—Production of light hydrocarbons in 1949 continued to shatter all former records when a total of 3,240,014 thousand gallons was recovered, a gain of 7 percent compared to the preceding year. The Texas output for the year represented approximately 50 percent of the Nation's entire production. Finished gasoline and naphtha increased 24 percent, LP-gases were up 8 percent, and natural gasoline declined 1.4 percent in 1949 compared with 1948.

Other States.—Outstanding was Colorado's greatly increased output of light liquids in 1949 over the previous year. Significant gains were recorded by Michigan, Montana, and New Mexico, while smaller increases were registered by Kansas, Kentucky, Mississippi, and West Virginia. Arkansas production remained virtually unchanged compared with 1948, whereas that of Illinois, New York, Ohio, Pennsylvania, and Wyoming decreased.

YIELDS, PROCESSES, AND NUMBER OF PLANTS

Cycle Plants.—Approximately 1,783,087 thousand gallons of light hydrocarbons were recovered at cycle plants in 1949 from 1,150,000,000 thousand cubic feet of natural gas—an indicated yield of 1.55 gallons per thousand cubic feet. This compares with 1.60 gallons per thousand cubic feet in 1948 and 1947.

Yields.—The average yield of all light products decreased slightly in 1949 compared with the preceding year. The yield in 1949 was 1.39 gallons per thousand cubic feet of gas processed as against 1.40 gallons the previous year. The yield of natural gasoline declined to 0.64 gallon per thousand cubic feet in 1949 from 0.68 gallon in 1948. The average yield of LP-gases during the year increased slightly to 0.51 gallon per thousand cubic feet compared with 0.50 gallon in 1948.

Propane production exceeded all former records, with an output of 874,708 thousand gallons, a gain of 12 percent over 1948.

The production of butane increased 31 percent in 1949 contrasted with the preceding year, but a moderate loss was reported in the output of commercial butane-propane mixtures.

The average value of natural-gas liquids recovered per 1,000 cubic feet of natural gas declined to 7.9 cents per gallon in 1949 as against 10.4 cents per gallon in 1948. The decrease resulted from a sharp break in the market for these products. Natural gasoline maintained its position as the most valuable of all products recovered, contributing 4.1 cents per 1,000 cubic feet of gas processed. LP-gases were valued at 2.1 cents and other products at 1.7 cents. Comparable amounts in 1948 were 5.9 cents, 2.7 cents, and 1.9 cents per 1,000 cubic feet of gas processed.

Production by Processes.—A gain of 2 plants was reported in 1948, when natural-gasoline and cycle plants numbered 548. The number of compression-type plants continued to decline, dropping from 135 in 1947 to 131 in 1948, but absorption plants increased from 373 to 376. Moreover, cycle plants gained 3 in number—from 38 to 41. An interesting fact is that, notwithstanding a 46-percent reduction in the total number of plants during the past 20 years, the over-all plant capacity has nearly trebled during this period.

A definite trend toward expansion of existing cycle plants is evidenced by construction completed during 1949. A typical example is the La Gloria Corp. plant, Falfurrias, Tex., where a large addition was constructed and designated the "casinghead-gasoline plant." Although it is adjacent to the cycle plant, it is operated as a separate plant, producing only raw, unfractionated natural gasoline.

Indicative of present-day technique is the Sun Oil Co. cycle plant, Star County, Tex., where all natural gas is completely utilized. Five oil fields are served by the plant, and in one instance casinghead gas is piped 26 miles to the plant. Although no one field can supply enough gas to warrant erection of this cycle plant, the combined gas capacity of the 5 fields—35 million cubic feet daily—was ample to justify construction of such facilities.

Natural gasoline and allied products produced in the United States in 1948, by States and by methods of manufacture [1]

State	Number of plants operating				Production (thousands of gallons)			
	Compression [2]	Absorption [3]	Cycling [4]	Total	Compression [2]	Absorption [3]	Cycling [4]	Total
Arkansas		8		8		94,855		94,855
California	3	74	2	79	93	935,770	179,201	[5] 1,115,064
Colorado		1		1		1,406		1,406
Illinois	6	6		12	245	148,382		148,627
Kansas	2	13		15	1,088	106,475		107,563
Kentucky		4		4		65,762		65,762
Louisiana	5	29	6	40	27,753	179,873	502,212	709,838
Michigan	1	1		2	141	2,442		2,583
Mississippi			1	1			47,177	47,177
Montana		1		1		8,447		8,447
New Mexico	1	8		9	5,704	124,634		130,338
New York	1			1	13			13
Ohio	2	7		9	20	6,278		6,298
Oklahoma	14	67		81	10,040	459,438		469,478
Pennsylvania	26	7		33	821	11,417		12,238
Texas	23	125	32	180	134,258	2,034,129	860,465	3,028,852
Utah						[6] 576		576
West Virginia	45	21		66	74,966	77,787		152,753
Wyoming	2	4		6	2,316	58,103		60,419
Total: 1948	131	376	41	548	257,458	4,315,774	1,589,055	6,162,287
1947	135	373	38	546	229,334	3,812,947	1,508,986	5,551,267

[1] Figures for 1949 not yet available.
[2] Includes 20 plants manufacturing LP-gases.
[3] Includes combination of absorption process with compression and charcoal processes. Includes 230 plants manufacturing LP-gases; and 3 charcoal plants in West Virginia and Ohio with 1,664,000 gallons produced in 1948 and 3 charcoal plants with 1,586,000 gallons in 1947.
[4] Includes 32 plants manufacturing LP-gases.
[5] Includes 35,070,000 gallons of field condensate.
[6] Drip gasoline.

MARKET DEMAND—SHIPMENTS

The total demand for natural-gas liquids processed at natural-gasoline and cycle plants was 6,706,096 thousand gallons—a new record and an increase of 7 percent over the 1948 peak. Deliveries of natural gasoline showed a slight increase of less than 1 percent, but LP-gases gained 9 percent in 1949 over the previous year. Shipments of condensate declined 2 percent, but those of finished gasoline and naphtha rose sharply, gaining 25 percent. The figures for LP-gases in the adjacent table do not include LR-gases produced at petroleum refineries.

Shipments to Refineries.—Shipments of natural-gas liquids to refineries totaled 3,764,960 thousand gallons, which represented 56 percent of the total demand in 1949. A definite pattern has been established during recent years, clearly indicating the declining relative importance of sales of light liquids to refineries. A slight gain (0.5 percent) was registered by natural-gasoline shipments to refineries during 1949, when 2,770,418 thousand gallons were received. Shipments of LP-gases to refineries totaled 513,162 thousand gallons, a 19-percent gain contrasted with 1948. Condensate shipments dropped 1.9 percent when only 338,929 thousand gallons were shipped to refineries.

Normal butane shipments to refineries in 1949 increased 97 percent, while isopentane dropped 10 percent and isobutane 18 percent compared with the preceding year.

Supply and distribution at plants of natural gasoline and allied products in the United States, 1948–49, by months, in thousands of gallons

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1948													
Production:													
Natural gasoline and natural-gasoline mixtures	230, 023	214, 812	237, 642	246, 987	259, 713	258, 674	263, 808	264, 374	235, 968	259, 958	251, 249	256, 204	2, 979, 412
LP-gases:													
Butane, normal	39, 798	43, 913	42, 999	36, 184	36, 523	37, 298	31, 048	36, 933	40, 569	43, 175	45, 754	46, 057	480, 251
Isobutane	15, 884	14, 197	17, 329	17, 669	17, 997	14, 184	17, 519	16, 963	14, 019	16, 750	16, 533	17, 310	196, 354
Propane	68, 728	64, 254	69, 910	55, 848	55, 727	50, 133	52, 691	59, 940	63, 860	73, 638	78, 830	86, 938	780, 497
Butane-propane mixture	52, 270	46, 686	48, 123	44, 345	39, 673	33, 950	38, 495	40, 630	42, 361	43, 852	43, 549	46, 520	520, 454
Other LP-gas mixtures	15, 374	14, 658	15, 566	13, 897	15, 173	14, 081	14, 017	12, 675	12, 916	14, 974	14, 306	17, 106	174, 743
Isopentane	4, 446	4, 058	4, 132	3, 994	5, 467	4, 593	4, 779	4, 276	4, 970	5, 420	4, 976	5, 661	56, 772
Finished gasoline and naphtha	42, 226	40, 842	45, 974	41, 329	41, 619	40, 316	41, 455	42, 684	43, 384	49, 113	49, 391	50, 602	528, 935
Condensate, raw	33. 014	30, 788	30, 593	27, 785	31, 275	28, 427	31, 153	28, 798	23, 061	27, 750	33, 373	34, 656	360, 673
Other products	6, 542	6, 369	7, 390	6, 647	7, 103	6, 535	6, 853	6, 579	6, 771	7, 621	7, 609	8, 177	84, 196
Total	508, 305	480, 577	519, 658	494, 685	510, 270	488, 191	501, 818	513, 852	487, 879	542, 251	545, 570	569, 231	6, 162, 287
Receipts from outside sources	15, 629	12, 790	17, 590	15, 483	13, 503	11, 460	12, 856	14, 504	17, 925	12, 632	11, 102	16, 859	172, 333
Stock change at plants and terminals	4, 956	7, 386	8, 673	18, 416	7, 458	10, 859	1, 873	8, 388	−307	3, 188	−11, 766	−9, 200	49, 924
Total supply	518, 978	485, 981	528, 575	491, 752	516, 315	488, 792	512, 801	519, 968	506, 111	551, 695	568, 438	595, 290	6, 284, 696
Shipments to refineries:													
Natural gasoline and natural-gasoline mixtures	213, 035	197, 963	218, 647	213, 302	250, 441	227, 928	241, 686	231, 830	226, 501	244, 235	244, 675	247, 437	2, 757, 680
Butane, normal	8, 897	7, 493	10, 229	7, 846	8, 620	9, 445	10, 564	10, 146	9, 538	11, 183	13, 034	13, 783	120, 778
Isobutane	14, 602	13, 960	16, 496	16, 092	16, 807	15, 707	16, 992	16, 432	13, 522	14, 918	15, 467	16, 372	187, 367
Isopentane	4, 023	3, 268	4, 311	5, 227	5, 545	4, 772	3, 997	3, 994	5, 239	4, 885	4, 772	5, 177	55, 210
Other LP-gases	7, 406	6, 693	6, 539	5, 904	5, 362	5, 104	5, 380	5, 674	4, 594	4, 954	5, 464	5, 497	68, 571
Finished gasoline and naphtha	12, 309	12, 150	11, 985	12, 083	11, 934	11, 608	12, 412	10, 918	11, 961	12, 659	12, 430	12, 946	145, 395
Condensate	32, 254	29, 827	29, 102	27, 645	29, 280	28, 267	30, 678	29, 090	21, 721	25, 162	30, 487	32, 107	345, 620
Shipments to jobbers and trade outlets:													
Natural gasoline	16, 675	15, 163	14, 570	13, 696	14, 749	9, 821	15, 849	17, 966	14, 168	14, 034	13, 189	12, 699	172, 579
LP-gases:													
For fuel [1]	141, 586	135, 130	134, 998	114, 624	106, 433	97, 343	107, 341	121, 271	124, 442	136, 136	142, 055	159, 081	1, 520, 440
For chemical manufacture	22, 891	22, 590	24, 970	23, 535	23, 929	22, 158	22, 700	19, 953	23, 679	26, 495	26, 149	26, 116	285, 165
Finished gasoline and naphtha	28, 433	26, 834	34, 975	29, 581	25, 976	31, 526	28, 393	28, 672	30, 907	31, 347	37, 741	36, 948	371, 333
Condensate	412	455	616	897	634	452	218	215	409	1, 449	1, 707	883	8, 407
Transfers of cycle products	6, 907	6, 701	7, 067	5, 768	6, 282	6, 019	5, 846	6, 408	6, 065	7, 711	7, 548	7, 990	80, 402
Exports and losses [1]	9, 458	7, 754	14, 070	15, 552	10, 323	18, 642	10, 745	17, 399	13, 365	16, 527	13, 660	18, 254	165, 749
Total demand at plants and terminals	518, 978	485, 981	528, 575	491, 752	516, 315	488, 792	512, 801	519, 968	506, 111	551, 695	568, 438	595, 290	6, 284, 696

See footnotes at end of table.

Supply and distribution at plants of natural gasoline and allied products in the United States, 1948–49, by months, in thousands of gallons—Continued

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1949 [2]													
Production:													
Natural gasoline and natural-gasoline mixtures	236,161	217,038	246,351	242,575	257,710	251,198	259,442	260,736	258,711	262,847	258,529	256,230	3,007,528
LP-gases:													
Butane, normal	47,378	50,470	51,742	49,656	48,185	47,664	49,554	52,780	54,115	57,297	59,196	60,958	628,995
Isobutane	12,843	12,701	14,910	14,464	16,126	14,185	14,189	14,572	14,262	16,275	15,592	15,182	175,301
Propane	82,232	77,545	70,623	60,310	56,524	53,447	57,506	64,089	73,018	85,305	90,834	103,275	874,708
Butane-propane mixture	49,331	44,939	39,781	39,884	33,440	31,567	35,173	39,237	42,395	45,137	48,471	54,842	504,197
Other (LP-gas) mixtures	16,722	14,969	18,022	15,885	15,202	13,050	13,824	13,729	13,376	15,146	16,577	16,869	183,371
Isopentane	4,630	3,575	4,622	3,914	4,903	4,906	3,694	5,154	3,513	5,648	4,606	2,699	51,864
Finished gasoline and naphtha	52,500	46,284	46,263	49,796	49,654	46,675	52,675	58,805	62,297	63,520	65,259	70,253	663,981
Condensate, raw	35,356	30,828	34,931	32,757	33,831	32,016	29,035	29,259	26,298	25,078	28,747	26,245	364,381
Other products	8,301	8,586	9,201	8,805	7,945	7,345	8,561	9,463	8,908	9,020	10,040	10,045	106,220
Total	545,454	506,935	536,446	518,046	523,520	502,053	523,653	547,824	556,893	585,273	597,851	616,598	6,560,546
Receipts from outside sources	22,077	19,158	14,546	13,280	12,968	9,238	14,180	11,559	17,914	13,294	15,719	17,331	181,264
Stock change at plants and terminals	22,810	25,723	16,017	−14,076	5,971	−18,592	18,340	−19,797	8,173	−11,597	10,661	−7,910	35,714
Total supply	544,721	500,370	534,975	545,402	530,517	529,883	519,493	579,180	566,634	610,164	602,909	641,848	6,706,096
Shipments to refineries:													
Natural gasoline and natural-gasoline mixtures	216,147	202,616	202,431	229,088	234,446	227,026	236,599	239,810	235,753	261,792	242,807	241,903	2,770,418
Butane, normal	15,239	18,855	23,292	20,628	20,015	16,698	20,205	17,627	17,823	21,933	21,308	23,537	238,060
Isobutane	11,428	11,688	13,263	13,119	14,127	13,112	12,408	12,699	12,095	13,596	12,910	12,736	153,181
Isopentane	3,785	4,179	3,622	3,399	4,200	4,845	4,379	5,104	3,785	4,455	4,052	3,890	49,755
Other LP-gases	6,066	6,406	7,255	6,917	5,794	5,135	5,748	5,513	5,837	5,158	5,904	6,433	72,166
Finished gasoline and naphtha	12,566	11,551	12,239	12,008	11,122	11,235	11,911	11,973	11,241	12,284	11,762	12,559	142,451
Condensate	30,803	27,227	30,337	30,263	30,591	30,042	27,742	29,434	25,734	23,330	27,434	25,992	338,929
Shipments to jobbers and trade outlets:													
Natural gasoline	12,461	12,358	12,635	14,604	14,408	18,836	18,371	16,328	15,468	15,991	17,598	14,496	183,554
LP-gases:													
For fuel [1]	156,257	133,727	123,282	122,177	104,123	102,257	107,336	130,166	137,293	153,240	171,563	193,699	1,635,120
For chemical manufacture	25,076	22,678	25,337	23,026	23,689	22,167	22,109	23,483	23,581	24,602	24,838	24,728	285,314
Finished gasoline and naphtha	33,421	26,239	39,831	34,350	42,393	44,816	35,098	47,889	47,848	50,573	49,129	53,736	505,323
Condensate	1,429	1,690	1,140	628	495	515	437	508	487	489	544	488	8,850
Transfers of cycle products	8,927	9,387	8,518	6,887	7,407	9,313	7,697	9,800	7,354	7.236	9,393	11,828	103,747
Exports and losses [1]	11,116	11,769	31,793	28,308	16,807	23,886	9,453	28,786	22,335	15,485	3,667	15,823	219,228
Total demand at plants and terminals	544,721	500,370	534,975	545,402	530,517	529,883	519,493	579,180	566,634	610,164	602,909	641,848	6,706,096

[1] Exports from plants and terminals totaling 24,852,000 gallons in 1948 and 14,013,000 gallons in 1949 are included with shipments of LP-gases for fuel and are excluded from "Exports and losses." This portion of the exports is not separable by months.
[2] Preliminary figures.

Natural gasoline and allied products utilized at refineries in the United States, 1948–49, by districts and months, in thousands of gallons

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
1948													
East Coast	2,688	3,822	2,142	2,436	3,192	2,142	714	2,268	1,848	3,192	6,426	6,174	37,044
Appalachian	2,100	2,142	2,226	1,890	1,974	1,932	2,058	2,016	2,100	2,016	2,184	3,360	25,998
Indiana, Illinois, Kentucky, etc.	31,206	28,728	29,190	30,744	30,030	29,442	28,476	29,022	29,736	30,576	29,358	27,258	353,766
Oklahoma, Kansas, Missouri	24,150	25,914	21,126	22,344	23,268	23,352	25,620	27,300	28,518	31,542	30,366	32,508	316,008
Texas:													
Gulf Coast	62,706	51,786	69,342	63,672	63,630	63,168	67,242	65,268	64,596	64,344	68,292	64,680	768,726
Inland	49,098	40,740	40,152	43,008	60,186	45,276	36,036	45,444	55,482	56,406	52,878	56,700	581,406
Total Texas	111,804	92,526	109,494	106,680	123,816	108,444	103,278	110,712	120,078	120,750	121,170	121,380	1,350,132
Louisiana-Arkansas:													
Louisiana Gulf Coast	9,492	8,946	10,416	8,568	8,568	7,812	10,248	11,466	11,214	14,490	14,868	17,808	133,896
Arkansas, Louisiana Inland	2,688	1,890	3,234	3,276	2,730	2,520	2,394	2,982	2,730	2,646	2,772	2,814	32,676
Total Louisiana-Arkansas	12,180	10,836	13,650	11,844	11,298	10,332	12,642	14,448	13,944	17,136	17,640	20,622	166,572
Rocky Mountain	4,116	3,612	3,318	4,242	3,024	2,184	2,394	2,226	3,864	3,696	4,662	5,334	42,672
California	81,984	71,610	78,708	74,256	78,540	73,290	81,984	86,478	50,316	69,006	80,220	83,370	909,762
Total United States	270,228	239,190	259,854	254,436	275,142	251,118	257,166	274,470	250,404	277,914	292,026	300,006	3,201,954
1949 [1]													
East Coast	7,854	9,870	4,074	3,822	3,528	3,948	8,526	4,032	4,284	7,140	8,610	5,292	70,980
Appalachian	3,066	1,974	1,932	1,806	1,428	1,470	1,680	1,638	1,722	2,184	1,806	2,268	22,974
Indiana, Illinois, Kentucky, etc.	28,896	29,652	31,920	34,650	35,910	30,366	33,306	42,378	36,750	38,304	25,788	26,922	394,842
Oklahoma, Kansas, Missouri	25,200	25,242	25,074	26,706	29,022	24,696	28,098	29,484	29,904	33,222	31,752	30,492	338,982
Texas:													
Gulf Coast	64,512	53,130	59,178	51,576	69,258	78,288	66,948	67,620	74,718	75,936	73,458	73,752	808,374
Inland	40,446	50,064	43,470	48,510	56,616	58,044	52,248	46,242	47,880	67,074	54,978	54,558	620,130
Total Texas	104,958	103,194	102,648	100,086	125,874	136,332	119,196	113,862	122,598	143,010	128,436	128,310	1,428,504
Louisiana-Arkansas:													
Louisiana Gulf Coast	17,388	13,230	14,364	13,398	15,246	15,330	16,128	17,346	16,422	15,834	19,782	21,000	195,468
Arkansas, Louisiana Inland	2,856	2,394	2,940	1,974	2,982	3,108	3,024	3,318	2,856	2,814	3,192	3,528	34,986
Total Louisiana-Arkansas	20,244	15,624	17,304	15,372	18,228	18,438	19,152	20,664	19,278	18,648	22,974	24,528	230,454
Rocky Mountain	4,452	2,856	4,284	4,242	6,300	3,528	3,990	4,662	6,048	6,174	5,292	4,872	56,700
California	78,204	76,776	88,998	81,984	83,832	87,654	91,350	90,678	93,156	99,960	88,200	84,966	1,045,758
Total United States	272,874	265,188	276,234	268,758	304,122	306,432	305,298	307,308	313,740	348,642	312,858	307,650	3,589,194

[1] Preliminary figures.

Percentage of natural gasoline and allied products in refinery gasoline in the United States, 1945–49, by districts

Year	East Coast	Appalachian	Indiana, Illinois, Kentucky	Oklahoma, Kansas, Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas, Louisiana Inland	Rocky Mountain	California	Total
1945	1.7	1.7	5.8	7.3	20.5	10.9	7.5	19.3	6.9	14.2	9.1
1946	1.2	1.9	5.0	7.9	22.7	8.8	5.1	16.6	4.7	15.4	8.4
1947	.8	2.0	5.5	7.7	22.6	8.8	5.3	10.3	3.9	17.4	8.7
1948	.8	2.4	5.0	8.9	25.0	8.3	4.8	7.1	3.8	17.2	8.5
1949 [1]	1.5	2.0	5.3	9.5	27.6	8.5	6.0	7.5	4.5	18.4	9.1

[1] Preliminary figures.

During 1949, 3,589,194 thousand gallons of natural gasoline and allied products were utilized at domestic refineries, a 12-percent increase over the previous year. The percentage of natural gasoline and allied products used in refinery gasoline varies greatly in different parts of the country. For example, in the Texas Inland refining district the light liquids utilized represented 28 percent of the total gasoline output at refineries, in California 18 percent, in Oklahoma-Kansas-Missouri 10 percent, and in Louisiana Gulf Coast 6 percent. The national average was 9.1 percent in 1949, 8.5 percent in 1948, and 8.7 percent in 1947.

"Direct" Sales.—Sales to jobbers and other trade outlets of natural gasoline amounted to 183,554 thousand gallons in 1949, a 6-percent gain over the preceding year. Sales of finished gasoline and naphtha totaled 505,323 thousand gallons, a marked increment of 36 percent contrasted with 1948. LP-gases utilized for fuel rose again, reaching 1,635,120 thousand gallons, an increase of 7.5 percent, illustrating the heavy demand for this product. However, shipments of LP-gases from the natural-gasoline plants to chemical plants in 1949 revealed virtually no change from the previous year, totaling 285,314 thousand gallons. Noteworthy is the unprecedented demand for finished gasoline and naphtha by jobbers and other market outlets.

SALES OF LP-GASES [3]

A large gain in market requirements for LP-gases, evident in recent years, failed to repeat in 1949, when sales of 2,836,599,000 gallons were only about 4 percent over the 1948 total of 2,736,801,000. The increase of 100 million gallons in sales of LP-gas in 1949 over the 1948 total is less than a fifth of the volume expansion in deliveries reported for 1948. Nominal gains in market requirements were reported for most areas in 1949 except for district 3, where sales remained at about the same level as in the previous year, and district 5, where the 1949 total was 4 percent below the 1948 demand. Exports of LP-gas declined in 1948, according to the United States Department of Commerce. However, an upward trend was again evident in 1949, when overseas shipments were 53,383,000 gallons, a gain of 17 percent over the 1948 total of 45,520,000 gallons.

[3] The survey covering sales of LP-gases in the Pacific Coast marketing area (district 5) was made by E. T. Knudsen, supervising economist. Bureau of Mines, Los Angeles, Calif.

The pronounced shift to a greater relative use of propane, evident in recent years, was repeated in 1949, when sales of 1,403,359,000 gallons were 10 percent over the 1948 total of 1,279,744,000 and made up about one-half of all deliveries compared with a 47-percent share in 1948. Requirements for butane declined 5 percent from 512,615,000 gallons in 1948 to 488,801,000 in 1949, and the relative part of the market for this gas dropped from 19 percent of the total in 1948 to 17 percent in 1949. There was virtually no change in the volume reported for butane-propane mixtures (944,439,000 gallons in 1949 compared with 944,442,000 in 1948) while the relative proportion for these mixtures declined from about 35 percent of total sales in 1948 to 33 percent in 1949. Propane reported for domestic (household) and commercial use, gas manufacturing, chemical raw material, internal-combustion-engine fuel, and miscellaneous uses all showed gains in 1949 over 1948, while quantities indicated for industrial fuel and synthetic rubber components were lower. More butane was sold for domestic consumption and miscellaneous uses in 1949 than in 1948; however, all other uses declined. Gains in sales of butane-propane mixtures for domestic fuel and chemical raw material in 1949 were completely offset by lower demands for other principal uses.

Sales of LP-gases in the United States, 1945–49

Year	Butane		Propane		Butane-propane mixture		Total	
	Thousand gallons	Percent of total	Thousand gallons	Percent of total	Thousand gallons	Percent of total	Thousand gallons	Increase over previous year, percent
1945	325,140	25.5	444,581	34.8	507,045	39.7	1,276,766	20
1946	441,418	25.9	551,250	32.3	711,594	41.8	1,704,262	34
1947	398,635	18.0	863,686	39.1	947,476	42.9	2,209,797	30
1948	512,615	18.7	1,279,744	46.8	944,442	34.5	2,736,801	24
1949	488,801	17.2	1,403,359	49.5	944,439	33.3	2,836,599	4

Sales of LP-gases in the United States, by uses, 1942–49, in thousands of gallons

Year	Domestic	Chemical	Synthetic rubber	Industrial	Gas manufacturing	Internal combustion	Other uses	Total
1942	299,559	53,038		114,132	31,366	82,456	4,889	585,440
1943	339,380	55,356	(1)	149,429	37,519	87,834	5,715	675,233
1944	445,617	151,985	162,085	162,018	45,879	92,495	77	1,060,156
1945	533,262	224,291	208,787	163,121	53,849	93,340	116	1,276,766
1946	758,466	311,499	293,892	159,115	86,660	94,592	38	1,704,262
1947	1,150,538	414,267	201,535	173,601	169,332	99,786	738	2,209,797
1948	1,473,289	[2] 524,350	225,641	[2] 180,518	237,638	92,941	2,424	2,736,801
1949	1,627,550	544,886	177,850	162,197	239,210	77,981	6,925	2,836,599

[1] Included in "Other uses."
[2] Revised figure.

The reporting of LP-gas sales by marketing districts, initiated in 1948, was repeated in 1949, so demand in the several areas for the 2 years can be compared. Sales in district 3 increased slightly from 1,122,870,000 gallons in 1948 to 1,123,349,000 in 1949, and the quantities represented about 40 percent of the national total for both years.

The market for LP-gas in district 2 rose by 9 percent from 788,142,000 gallons in 1948 to 855,816,000 in 1949, and the relative share for the area was 29 percent of total deliveries in 1948 and 30 percent in 1949. Distributors in district 1 reported about 17 percent of the LP-gas sales in both years, and the volume rose by 8 percent from 454,555,000 gallons in 1948 to 491,753,000 in 1949. The only market to show a decline in sales was district 5, where requirements dropped from 325,307,000 gallons in 1948 (12 percent of all sales) to 312,014,000 in 1949 (11 percent of the national market). Less than 2 percent of the LP-gas is credited to district 4; however, sales in that area increased from 45,927,000 gallons in 1948 to 53,667,000 in 1949—a gain of 17 percent.

Sales of LP-gases in the United States, by use and district,[1] 1948–49, in thousands of gallons

Use and district [1]	Butane		Propane		Butane and propane mixture		Total LP-gases		Percent increase 1949
	1948	1949	1948	1949	1948	1949	1948	1949	
Domestic and commercial:									
District 1	17,159	19,927	193,515	223,146	35,670	39,173	246,344	282,246	15
District 2	22,419	44,149	317,068	359,194	119,667	124,129	459,154	527,472	15
District 3	58,986	73,823	138,260	142,168	351,852	354,730	549,098	570,721	4
District 4	7,595	13,895	28,643	29,463	4,325	6,244	40,563	49,602	22
District 5	6,842	2,805	88,467	100,485	82,821	94,219	178,130	197,509	11
Total	113,001	154,599	765,953	854,456	594,335	618,495	1,473,289	1,627,550	10
Gas manufacturing:									
District 1	20,521	18,656	45,156	47,681	3,906	4,790	69,583	71,127	2
District 2	36,445	37,421	69,890	74,265	20,990	16,278	127,325	127,964	1
District 3	2,206	1,730	1,802	3,099	3,775	3,456	7,783	8,285	6
District 4	2,588	1,353	--------	310	1,243	955	3,831	2,618	−32
District 5	1,812	2,341	16,227	19,528	11,077	7,347	29,116	29,216	(2)
Total	63,572	61,501	133,075	144,883	40,991	32,826	237,638	239,210	1
Industrial plants:									
District 1	7,042	4,495	48,135	43,855	1,336	1,352	56,513	49,702	−12
District 2	43,414	35,404	40,095	45,120	8,785	5,300	92,294	85,824	−7
District 3	[3] 1,286	1,050	[3] 596	1,524	[3] 1,510	7,262	[3] 3,392	9,836	190
District 4	--------	1,147	1,033	174	--------	--------	1,033	1,321	28
District 5	2,678	1,247	10,757	9,063	13,851	5,204	27,286	15,514	−43
Total	[3] 54,420	43,343	[3] 100,616	99,736	[3] 25,482	19,118	[3] 180,518	162,197	−10
Synthetic rubber:									
District 1	563	121	870	--------	--------	7	1,433	128	−91
District 2	19,311	21,816	1,267	--------	2	1	20,580	21,817	6
District 3	159,197	124,496	785	--------	26,737	19,855	186,719	144,351	−23
District 4	--------	--------	--------	--------	--------	--------	--------	--------	--------
District 5	15,706	10,174	1,203	1,380	--------	--------	16,909	11,554	−32
Total	194,777	156,607	4,125	1,380	26,739	19,863	225,641	177,850	−21
Chemical plants:									
District 1	178	1,780	4,915	388	74,873	84,599	79,966	86,767	9
District 2	--------	--------	785	5,109	44,706	46,745	45,491	51,854	14
District 3	[3] 56,071	46,983	[3] 220,930	243,571	[3] 76,992	80,021	[3] 353,993	370,575	5
District 4	--------	--------	--------	--------	--------	--------	--------	--------	--------
District 5	10,203	7,713	34,697	27,977	--------	--------	44,900	35,690	−21
Total	[3] 66,452	56,476	[3] 261,327	277,045	[3] 196,571	211,365	[3] 524,350	544,886	4
Internal combustion:									
District 1	380	--------	52	24	--------	1,633	432	1,657	284
District 2	16,491	10,958	7,514	9,999	18,754	17,338	42,759	38,295	−10
District 3	49	1,878	1,004	2,443	19,231	11,051	20,284	15,372	−24
District 4	6	5	41	115	453	6	500	126	−75
District 5	3,093	2,152	5,521	7,683	20,352	12,696	28,966	22,531	−22
Total	20,019	14,993	14,132	20,264	58,790	42,724	92,941	77,981	−16

See footnotes at end of table.

Sales of LP-gases in the United States, by use and district,[1] 1948–49, in thousands of gallons—Continued

Use and district [1]	Butane		Propane		Butane and propane mixture		Total LP-gases		Percent increase 1949
	1948	1949	1948	1949	1948	1949	1948	1949	
All other:									
District 1	1	1	283	123		2	284	126	−56
District 2	54	1,252	232	1,326	253	12	539	2,590	381
District 3	319	29	1	4,146	1,281	34	1,601	4,209	163
District 4									
District 5									
Total	374	1,282	516	5,595	1,534	48	2,424	6,925	186
Total:									
District 1	45,844	44,980	292,926	315,217	115,785	131,556	454,555	491,753	8
District 2	138,134	151,000	436,851	495,013	213,157	209,803	788,142	855,816	9
District 3	278,114	249,989	363,378	396,951	481,378	476,409	1,122,870	1,123,349	(2)
District 4	10,189	16,400	29,717	30,062	6,021	7,205	45,927	53,667	17
District 5	40,334	26,432	156,872	166,116	128,101	119,466	325,307	312,014	−4
Total sales for U. S. use	512,615	488,801	1,279,744	1,403,359	944,442	944,439	2,736,801	2,836,599	4
Exports							45,520	53,383	17
Grand total sales							2,782,321	2,889,982	4

[1] The States in each district are as follows:
DISTRICT 1.—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida.
DISTRICT 2.—North Dakota, South Dakota, Minnesota, Nebraska, Iowa, Wisconsin, Illinois, Indiana, Michigan, Ohio, Kentucky, Tennessee, Missouri, Kansas, Oklahoma.
DISTRICT 3.—New Mexico, Texas, Arkansas, Louisiana, Mississippi, Alabama.
DISTRICT 4.—Idaho, Montana, Wyoming, Utah, Colorado.
DISTRICT 5.—California, Oregon, Washington, Arizona, Nevada.
[2] Less than 0.5 percent.
[3] Revised figure.

Domestic (Household) and Commercial Uses.—Sales of LP-gas for domestic and commercial consumption did not show the large relative increase in 1949 as in recent years, when deliveries of 1,627,550,000 gallons were only 10 percent over the 1948 total of 1,473,289,000 gallons in contrast to gains of 28 percent in 1948 and 52 percent in 1947. More than half (52 percent) of the LP-gas sold for domestic use is propane, and the 1949 quantity (854,456,000 gallons) was about 12 percent over the 1948 total. Butane-propane mixtures are also widely used in some areas for domestic fuel; however, the 1949 total (618,495,000 gallons) was only 4 percent above the 1948 demand, and their proportionate share of the market dropped from 40 percent in 1948 to 38 percent in 1949. Relatively little butane is sold for household fuel purposes; however, the quantity reported—154,499,000 gallons—was about 37 percent over 1948 requirements.

There was very little change in the relative proportions of LP-gas sold for domestic fuel in the several marketing areas in 1949 compared with 1948. Sales reported for district 3 declined from about 37 percent of the national total in 1948 to 35 percent in 1949, while there were slight gains in districts 1 and 2. District 2 was credited with 31 percent of all deliveries for domestic fuel in 1948 and 32 percent in 1949, while 17 percent of the total was reported for district 1—a small gain over 1948. Distributors in districts 4 and 5 reported about 3 and 12 percent, respectively, of the domestic item for both years under review.

Gas-Manufacturing Plant Use.—There was little change in the quantity of LP-gas sold to gas-manufacturing plants for use as an enriching agent and for direct distribution through their mains in 1949, as the total 239,210,000 gallons was less than 1 percent above 1948 requirements (237,638,000 gallons). Propane sold for these purposes increased 9 percent in 1949, while the butane total was lower by 3 percent and mixtures were down sharply—20 percent—for the year. Propane delivered to manufactured-gas companies represented 61 percent of their requirements in 1949 compared with a 56-percent share in 1948. The butane in the total declined from 27 percent in 1948 to 26 percent in 1949, while butane-propane mixtures shrank from 17 percent of the manufactured-gas-company item in 1948 to 14 percent in 1949.

More than half (54 percent for both 1948 and 1949) of the LP-gases sold to manufactured-gas companies was reported for district 2, while an additional 30 percent was credited to district 1. About 12 percent of the national total is delivered to gas companies in the Pacific Coast area or district 5, while only relatively small amounts are used in other areas.

Industrial-Plant Use.—LP-gases sold to industrial plants for fuel and other uses declined from a revised total of 180,518,000 gallons in 1948 to 162,197,000 in 1949—a 10-percent shrinkage. The propane in the 1949 total—99,736,000 gallons—was only about 1 percent below the 1948 quantity, but the butane—43,343,000 gallons in 1949—and the mixture—19,118,000 gallons in 1949—were 20 and 25 percent, respectively, under 1948 requirements. The propane share of the LP-gases sold to industrial plants increased from 56 percent of the total in 1948 to 61 percent in 1949, while the butane was down from 30 percent of the 1948 item to 27 percent in 1949. Mixtures represented 14 percent of these deliveries in 1948 and only 12 percent in 1949.

The larger share of the LP-gas sold to industrial plants was reported from district 2, and the proportion for the area increased from 51 percent of the total in 1948 to 53 percent in 1949. Another 31 percent was credited to district 1, while only relative small amounts of this industrial fuel were delivered in remaining areas, with the possible exception of district 5, where the demand dropped from 15 percent of the national total in 1948 to 10 percent in 1949.

Synthetic Rubber Components.—The sharp drop in the manufacture of synthetic rubber in 1949 was reflected in the lower demand for LP-gas used as raw material, as the total of 177,850,000 gallons was about 21 percent below 1948 requirements (225,641,000 gallons). Butane is mostly used to make synthetic rubber, and the sales of this gas for the purpose declined by 20 percent from 194,777,000 gallons in 1948 to 156,607,000 in 1949. Relatively smaller amounts of mixtures—26,739,000 gallons in 1948 and 19,863,000 in 1949—and propane—4,125,000 gallons in 1948 and 1,380,000 in 1949—are also sold for the manufacture of synthetic rubber.

Over four-fifths of the LP-gases delivered for synthetic rubber components were reported from district 3, where most of the manufacturing plants are situated.

Raw Material and Solvents for Chemical Plants.—LP-gas sold to chemical plants showed a nominal increase (4 percent) from a revised total

of 524,350,000 gallons in 1948 to 544,886,000 in 1949. About half the LP-gas delivered for chemical raw material is reported as propane, and the quantity increased 6 percent from 261,327,000 gallons in 1948 to 277,045,000 in 1949. Butane-propane mixtures constituted over a third of the total (38 percent in 1948 and 39 percent in 1949), and deliveries of these to chemical plants were 211,365,000 gallons in 1949, a gain of 8 percent over the 196,571,000 gallons in 1948. Only relatively small amounts of butane are used as chemical raw material, and the demand declined from 66,452,000 gallons in 1948 to 56,476,000 in 1949.

Most of the chemical plants using LP-gas for raw material and solvents are in district 3, and the quantities sold in that area represented 68 percent of the total for both 1948 and 1949. Relatively smaller amounts were credited to district 1—16 percent of the total in 1949—and to district 2—10 percent of all such deliveries for the same year. Sales of LP-gas to chemical plants in district 5 dropped from 9 percent of the total in 1948 to 7 percent in 1949.

Internal-Combustion-Engine Fuel.—LP-gas sold for engine fuel declined from 92,941,000 gallons in 1948 to 77,981,000 in 1949. It is believed that at least part of this large indicated shrinkage in demand is due to some overreporting in 1948. The quantities of butane and butane-propane mixtures sold for internal-combustion-engine fuel both fell in 1949, while the demand for propane showed a large increase. The butane reported in 1949—14,993,000 gallons—was a fourth below the 1948 quantity (20,019,000 gallons), while "mixtures" were down similarly from 58,790,000 gallons in 1948 to 42,724,000 in 1949. Propane used for engine fuel was greater in volume by nearly half—from 14,132,000 gallons in 1948 to 20,264,000 in 1949.

Approximately half of the LP-gas used for internal-combustion-engine fuel was reported from district 2, and sales in that area were down 10 percent. Deliveries in district 5 accounted for about a third of the demand, and there the 1949 quantity was 22 percent below 1948 requirements. District 3 was a market for about one-fifth of this fuel, and dealers there reported sales in 1949 a quarter under the 1948 item. Only minor quantities of LP-gas were sold for engine fuel in districts 1 and 4.

STOCKS

Stocks of light liquids December 31, 1949, totaled 286,888,000 gallons, an increase of 22 percent compared with the previous year. Stocks increased from January to July, when a peak of 322,067,000 gallons was reached; however, the decline was fairly constant during the balance of 1949. Stocks of natural gasoline gained 14 percent and LP-gases increased 12 percent, whereas other products gained 70 percent. Stocks of light products appeared to be adequate to supply the ever-expanding demand.

Stocks of natural gasoline and allied products in the United States, 1945–48, and 1949, by months, in thousands of gallons

Date	Natural gasoline		LP-gases		Other products		Total		
	At plants and terminals	At refineries	At plants and terminals	At refineries	At plants and terminals	At refineries	At plants and terminals	At refineries	Grand total
Dec. 31:									
1945	67,412	34,314	22,255	17,262	22,840	17,430	112,507	69,006	181,513
1946	97,339	41,328	20,882	11,382	28,282	9,996	146,503	62,706	209,209
1947	75,338	43,008	24,723	5,502	19,961	11,886	120,022	60,396	180,418
1948	106,589	44,982	31,421	12,726	31,936	6,678	169,946	64,386	234,332
1949									
Jan. 31	122,199	47,922	31,682	14,700	38,875	5,754	192,756	68,376	261,132
Feb. 28	129,979	55,398	42,722	13,230	45,778	8,064	218,479	76,692	295,171
Mar. 31	147,033	51,996	46,610	16,338	40,853	8,190	234,496	76,524	311,020
Apr. 30	133,614	57,120	42,029	15,288	44,777	11,802	220,420	84,210	304,630
May 31	139,784	60,774	44,771	14,154	41,836	10,248	226,391	85,176	311,567
June 30	133,119	64,764	44,140	16,086	30,540	6,636	207,799	87,486	295,285
July 31	142,634	71,526	44,673	17,388	38,832	7,014	226,139	95,928	322,067
Aug. 31	133,546	73,794	36,924	16,716	35,872	13,566	206,342	104,076	310,418
Sept. 30	134,149	73,038	40,272	13,986	40,094	17,976	214,515	105,000	319,515
Oct. 31	117,623	55,860	42,273	15,078	43,022	16,926	202,918	87,864	290,782
Nov 30	124,857	56,070	40,594	14,952	48,128	15,330	213,579	86,352	299,931
Dec. 31	122,605	49,602	33,730	15,498	49,325	16,128	205,660	81,228	286,888

PRICES

The average price of 26–70 natural gasoline in 1949 was 5.89 cents per gallon f. o. b. group 3, a sharp drop from the previous year's average price of 8.5 cents per gallon, equivalent to 31 percent. The high price for 1949 was established in January at 8.45 cents per gallon. The market weakened in February and by April the price had declined to 5.07 cents per gallon, the lowest of the year. A slight recovery took place during the fall and winter months, and the price leveled off to 5.88 during October, November, and December.

An identical pattern was followed by this product f. o. b. Breckenridge, Tex., where the average price of 26–70 natural gasoline during 1949 was 5.40 cents per gallon, a 33-percent decrease from the preceding year. High for 1949 was 7.95 cents per gallon in January, while

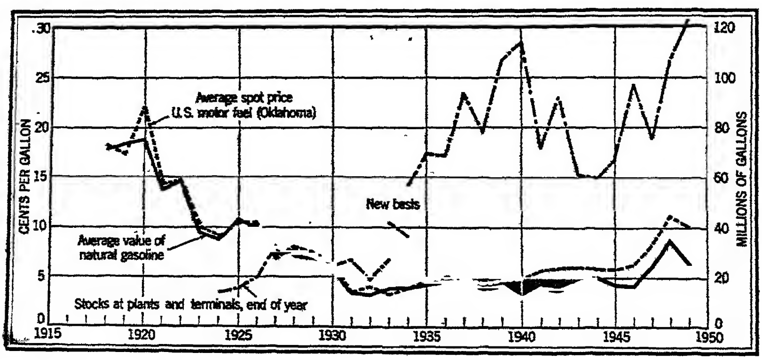

FIGURE 2.—Trends in average value of natural gasoline, spot price of gasoline, and stocks of natural gasoline, 1918–49.

the low was 4.58 cents per gallon in April, with the market strengthening to 5.38 cents per gallon during the last quarter.

The average price of regular-grade gasoline f. o. b. Oklahoma (group 3) approximated 10.13 cents per gallon during 1949, a decline of about 1 cent per gallon compared to the previous year; however, the market was unusually steady throughout the entire period.

Average monthly refinery prices for several grades of LP-gas at various cities are shown in Platt's Oil Price Handbook for 1947 and 1948; however, the quotations in the 1949 edition are limited to New York and Philadelphia. The average refinery prices for 1949 showed pronounced declines from 1948 levels and approached values prevailing in 1947. The average refinery price for commercial propane at New York Harbor rose from 6.58 cents in 1947 to 9 cents in 1948 and declined to a 6.49-cent average in 1949. Commercial propane at Philadelphia averaged 6.56 cents a gallon in 1947, 8.94 cents in 1948, and then down to 6.44 cents in 1949.

TECHNOLOGY

Owing to the vast expansion program in the natural-gasoline industry, the daily capacity of all natural-gasoline plants totaled 20.6 million gallons by the end of 1949, and cycle plants accounted for an additional 6.6 million gallons capacity per day. The trend toward extraction of higher propane yields has been accelerated during the year by installation of refrigeration or other equipment, which results in lowering the temperature of the absorption oil, or through increasing the lean-oil circulation rate. An article in the Oil and Gas Journal (April 20, 1950) entitled "Application of Refrigeration Results in Obtaining Higher Yields," states:

> A method for achieving this result is the use of rich-oil deethanization prior to stripping. Where propane recoveries in the range of 70 percent are desired, this scheme has been found to result in low capital and operating costs. Through use of special heat-exchanger arrangements, good heat economy likewise is obtained.

Another significant trend is the underground storage of surplus LP-gases during summer months. This procedure is considerably beyond the experimental stage, one company stores 95,000 barrels of LP-gases in the Bodcaw sand in Oklahoma. A twofold purpose was served: (1) An adequate supply of LP-gases was available during the winter months; and (2) storage of these products was a conservation program, as it was not necessary to burn them during the slack season.

Another company reports economical storage of LP-gases, utilizing salt-water sands, where surplus products may be stored until demand warrants their removal from the underground reservoirs. The products can then be re-produced without further processing, other than removal of the salt water.

Still another trend is the upgrading of cycle-plant gasoline octane number at central plants, to improve its competitive position relative to refinery gasolines. Another noteworthy development of natural-gasoline and cycle plants is the sharp increase in the manufacture of finished gasoline and naphtha which gained over 25 percent in 1949 compared with the preceding year. Some cycle plants have installed small catalytic reformer units to manufacture high-quality finished motor fuel.

FOREIGN TRADE [4]

Exports of natural gasoline in 1949 totaled 183,267 thousand gallons, contrasted with 170,774 thousand gallons the preceding year, an increase of 7 percent. Value of the product decreased to $17,464,514 in 1949 in comparison with $20,126,140 the previous year owing to the break in the natural-gasoline market. Canada was the largest importer, taking 32 percent of United States exports; the United Kingdom was next with 24 percent, and the Netherlands Antilles received 20 percent.

Shipments of LP-gases abroad totaled 53,383 thousand gallons valued at $5,777,393 compared with 45,520 thousand gallons valued at $5,259,048 in 1948. Canada continued to be the largest importer, with 58 percent; Mexico ranked second, with 30 percent, Brazil 6 percent, and Philippine Republic almost 2 percent. Many other countries received shipments during 1949 in smaller quantities.

LP-gases exported from the United States, 1945–49, by countries, in thousands of gallons [1]

[U. S. Department of Commerce]

Country	1945	1946	1947	1948	1949
Argentina	7	40	8	290	546
Bermuda	103	147	198	269	282
Brazil	63	289	1,570	1,720	3,405
Canada	15,044	30,379	31,591	26,681	31,195
Cuba			59	259	463
France		1,941	2,082	(2)	(2)
Mexico	10,615	15,955	16,471	15,497	16,120
Philippines, Republic of	12	101	402	568	894
United Kingdom			446	(2)	(2)
Other countries	215	239	406	236	478
Total	26,059	49,091	53,233	45,520	53,383

[1] Converted from pounds to gallons at 4.5 pounds per gallon.
[2] Less than 500 gallons; included with "Other countries."

[4] Figures on exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Nickel

By Hubert W. Davis

GENERAL SUMMARY

THE 2-year upward trend in consumption of nickel in the United States was reversed in 1949, largely because of marked declines in outputs of engineering and stainless steels, and copper-nickel alloys. Total consumption of nickel in 1949 was 27 percent smaller than in 1948, which, however, was a peacetime record. On the other hand, deliveries to the National Stockpile were substantially greater. Despite the much smaller consumption, output of nickel in Canada declined only 3 percent in 1949. The drop in sales of Canadian nickel, however, was more pronounced. Imports of nickel into the United States were 5 percent less in 1949 than in 1948. Receipts of nickel from Canada dropped 6 percent, but this decline was partly offset by a gain of 22 percent in imports from Norway. Production of nickel matte and ferronickel in New Caledonia was hampered by an inadequate supply of ore. Domestic output of nickel was, as heretofore, small in 1949.

Salient statistics for nickel, 1945–49

	1945	1946	1947	1948	1949
United States:					
Production:					
Primary short tons	1,155	352	646	883	790
Secondary do	6,483	8,248	9,541	8,850	5,680
Imports (gross weight) [1] do	122,528	104,734	88,408	106,939	97,144
Exports (gross weight) [2] do	3,876	7,977	12,037	8,184	4,503
Consumption do	96,252	80,105	80,757	93,558	68,326
Price per pound [3] cents	31½	31½–35	35	33¾–40	40
Canada:					
Production short tons	122,565	96,062	118,627	131,740	128,328
Exports do	108,222	111,422	117,056	131,840	127,141
World production do	160,000	136,000	154,000	166,000	161,000

[1] Excludes "All other manufactures of nickel"; weight not recorded.
[2] Excludes "Manufactures"; weight not recorded.
[3] Price quoted to United States buyers by International Nickel Co., Inc., for electrolytic nickel in carlots f. o. b. Port Colborne, Ontario; price includes duty of 2½ cents a pound 1945–47 and 1¼ cents 1948–49.

The steel industry continued to be the chief consumer of nickel in the United States. Usage of nickel in stainless steels was 27 percent less in 1949 than in 1948, but that for other steels was 38 percent smaller. Consumption of nickel in high-temperature and electric-resistance alloys was down 34 percent, but that for anodes decreased only 3 percent. The use of nickel in cast irons was 19 percent less. Most of the nickel consumed in 1949 was in the form of metal; proportionately less oxide and oxide sinter were used than in 1948.

Since July 22, 1948, the contract price to United States buyers for electrolytic nickel in carlots f. o. b. Port Colborne, Ontario, has been 40 cents a pound, including duty of 1¼ cents a pound; and for nickel oxide sinter (on which there is no duty) f. o. b. Copper Cliff, Ontario, 36¼ cents (nickel content) a pound.

PRODUCTION

Domestic production of nickel is small and comprises metals recovered from scrap-nickel anodes, nickel-silver, and copper-nickel alloys (including Monel metal) and primary nickel recovered in copper refining and produced from ore and as a byproduct of talc production. Domestic primary nickel production totaled 1,581,000 pounds in 1949 and comprised both crude and refined nickel sulfate recovered as a byproduct of copper refining at Baltimore, Md.; Carteret and Perth Amboy, N. J.; Laurel Hill, N. Y.; and Tacoma, Wash. Shipments were 1,577,000 pounds, the bulk of which was crude nickel sulfate sold to refiners for use as an intermediate in the manufacture of refined nickel salts. Although all the nickel recovered as a byproduct of copper refining is credited to domestic production, some is recovered from imported blister copper. There has been no production of nickel from ore or as a byproduct of talc production since 1945.

In addition to the nickel recovered as a byproduct of copper refining in 1949, 4,618,000 pounds (nickel content) of refined salts (chiefly sulfate) were produced in the United States from Canadian cobalt-nickel ore and nickel residues, from domestic crude nickel sulfate, and from nickel cathode, shot, and scrap.

The total production of refined nickel salts in the United States was 5,125,000 pounds (nickel content) in 1949; shipments to consumers for electroplating, catalysts, and ceramics were 4,987,000 pounds.

Nickel produced in the United States, 1945–49

Year	Primary (short tons) [1]		Secondary	
	Byproduct of copper refining	Other	Short tons	Value
1945	719	436	6,483	$4,538,100
1946	352		8,248	5,801,600
1947	646		9,541	7,188,189
1948	883		8,850	6,966,720
1949	790		5,680	4,877,984

[1] Bureau of Mines not at liberty to publish value.

CONSUMPTION AND CONSUMERS' STOCKS

The accompanying tables give data on consumption and consumers' stocks of nickel. The data cover all known consumers of nickel in the form of primary and secondary metal, matte, and oxide. The figures for nickel salts, however, fall short of the total and probably represent only 51 and 43 percent, respectively, of the totals in 1949 and 1948.

Nickel (exclusive of scrap) consumed and in stock in the United States, 1948–49, by forms, in pounds of nickel

Form	1948			1949		
	Consumption	Stocks at consumers' plants Dec. 31	In transit to consumers' plants Dec. 31	Consumption	Stocks at consumers' plants Dec. 31	In transit to consumers' plants Dec. 31
Metal [1]	130, 911, 216	[2] 14, 821, 331	1, 340, 622	99, 377, 479	12, 473, 528	245, 459
Oxide and oxide sinter	33, 052, 564	3, 898, 439	281, 888	19, 514, 759	2, 184, 431	216, 131
Matte	21, 238, 604	2, 119, 330	312, 115	15, 654, 621	2, 908, 419	----------
Salts	1, 914, 134	[2] 443, 786	3, 344	2, 105, 369	301, 822	10, 541
Total	187, 116, 518	[2] 21, 282, 886	1, 937, 969	136, 652, 228	17, 868, 200	472, 131

[1] Includes secondary nickel (ingot or shot remelted from scrap nickel and scrap-nickel alloys).
[2] Revised figure.

Nickel (exclusive of scrap) consumed in the United States, 1945–49, by uses, in pounds of nickel

Use	1945	1946	1947	1948	1949
Ferrous:					
Stainless steels	} 111, 114, 967	35, 986, 164	30, 700, 270	32, 487, 815	23, 817, 187
Other steels		31, 193, 998	34, 758, 963	43, 564, 600	26, 948, 418
Cast irons	6, 025, 564	5, 973, 919	7, 905, 576	8, 431, 667	6, 792, 472
Nonferrous [1]	52, 802, 013	51, 819, 728	54, 747, 667	56, 067, 736	37, 942, 549
High-temperature and electrical-resistance alloys	7, 902, 392	13, 596, 601	10, 249, 545	12, 336, 123	8, 107, 918
Electroplating:					
Anodes	} 12, 736, 349	17, 059, 306	17, 975, 335	28, 425, 717	27, 620, 766
Solutions		566, 916	1, 218, 268	1, 327, 396	1, 448, 584
Catalysts	890, 253	544, 093	878, 664	1, 190, 851	994, 206
Ceramics	43, 042	387, 655	385, 112	370, 708	299, 246
Other	990, 168	3, 082, 394	2, 694, 459	2, 913, 905	2, 680, 882
Total	192, 504, 748	160, 210, 774	161, 513, 859	187, 116, 518	136, 652, 228

[1] Comprises copper-nickel alloys, nickel-silver, brass, bronze, beryllium alloys, magnesium and aluminum alloys, Monel, Inconel, and malleable nickel.

FOREIGN TRADE [1]

Imports of nickel into the United States were 5 percent less in 1949 than in 1948. Imports in 1949 comprised chiefly refined nickel, matte, oxide, scrap, and nickel residues. As heretofore, Canada was the chief source of the imports; it supplied 137,072,528 pounds of refined nickel (pig, ingot, shot, and cathode), 3,327 pounds of bars, rods, etc., 22,256,644 pounds of roasted and sintered matte (averaging about 68 percent nickel), 24,483,602 pounds of oxide and oxide sinter (averaging about 74 percent nickel), 224,632 pounds of nickel scrap, and an undetermined quantity of nickel residues. The matte is refined to Monel metal at the plant of the International Nickel Co., Inc., Huntington, W. Va. Norway furnished 7,572,420 pounds of refined nickel. The United Kingdom supplied 35,607 pounds of refined nickel, 2,406,474 pounds of nickel scrap, and 808 pounds of bars, rods, etc. Germany furnished 344 pounds of refined nickel and 4,634 pounds of bars, rods, etc., and Netherlands, Belgium-Luxembourg, Mozambique, and Libya 196,038, 29,485, 450, and 399 pounds,

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

respectively, of nickel scrap. Sweden supplied 57 pounds of bars, rods, etc.

The nickel content of the unmanufactured nickel products imported into the United States is estimated at 182,942,000 pounds in 1949, compared with 192,800,000 pounds (revised figure) in 1948.

Since January 1, 1948, the rate of duty on refined nickel imported into the United States has been 1¼ cents a pound. Nickel ore, matte, oxide, and scrap entered the United States duty free.

Exports of nickel comprise largely products manufactured from imported raw materials. Exports of alloys and scrap (including Monel metal), which comprise the bulk of the foreign shipments, were 52 percent less in 1949 than in 1948; those of refined nickel, nickel-chrome electric-resistance wire, and nickel silver were 40, 8, and 19 percent, respectively, smaller.

The United Kingdom (3,405,107 pounds) and Canada (2,646,415 pounds) were the chief foreign markets for refined nickel, Monel metal, alloys, and scrap in 1949.

Nickel products (excluding residues) imported for consumption in the United States, 1947–49, by classes

[U. S. Department of Commerce]

Class	1947		1948		1949	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured:						
Nickel ore and matte	29,272,226	$3,750,870	27,708,041	$3,576,268	22,256,644	$4,598,335
Nickel pigs, ingots, shot, cathodes, etc.	117,372,931	35,368,075	[1] 140,564,020	[1] 47,075,103	[1] 144,680,899	[1] 54,427,004
Nickel scrap			[1] 2,539,698	[1] 348,481	[1] 2,857,478	[1] 389,118
Nickel bars, rods, tubes, etc.	1,516	1,455	31,012	30,290	8,826	17,039
Nickel oxide	30,147,686	6,458,240	43,028,224	10,000,860	24,483,602	6,584,951
Manufactured:						
Nickel-silver or German silver in sheets, strips, rods, and wire	21,799	11,095	7,754	3,467		
All other manufactures of nickel	(2)	5,834	(2)	5,082	(2)	5,489
Total		45,595,569		61,039,551		66,021,936

[1] Adjusted by Bureau of Mines.
[2] Quantity not recorded.

Nickel products exported from the United States, 1947–49, by classes

[U. S. Department of Commerce]

Class	1947		1948		1949	
	Pounds	Value	Pounds	Value	Pounds	Value
Ore, concentrates, and matte	1,510	$861	1,500	$1,725	116,000	$16,066
Alloys and scrap containing nickel (including Monel metal)	16,848,166	6,287,395	11,652,796	4,718,518	5,568,949	2,881,834
Metal in ingots, bars, sheets, etc	2,712,787	1,528,451	2,705,777	1,494,350	1,610,329	959,725
Manufactures	(1)	1,119,984	(1)	745,916	(1)	922,352
Nickel-chrome electric resistance wire	1,386,457	2,021,879	747,082	1,197,348	686,270	979,813
Nickel-silver or German silver, crude, scrap, or bars, rods, etc	3,125,017	1,197,860	1,260,330	591,858	1,024,613	442,775
Total		12,156,430		8,749,715		6,202,565

[1] Quantity not recorded.

WORLD REVIEW

The accompanying table shows world production of nickel by countries, 1942–49, insofar as statistics are available. Despite the fact that nickel is produced in many countries, one country—Canada—has supplied about 78 percent of the world output since 1942.

World mine production of nickel, by countries, 1942–49, in metric tons of contained metal

[Compiled by Berenice B. Mitchell]

Country	1942	1943	1944	1945	1946	1947	1948	1949
Brazil	1	-------	6	60	-------	-------	-------	(1)
Canada	129,369	130.642	124.555	111,189	87,146	107,616	119,512	116,417
Cuba	(1)	2,430	4.679	10,900	11,241	2,014	-------	-------
Finland	1,630	8,970	313	900	622	540	-------	-------
French Morocco	(1)	45	47	-------	-------	-------	-------	-------
Germany	577	951	(1)	(1)	-------	-------	-------	-------
Greece	706	495	-------	-------	-------	-------	-------	-------
Indonesia	[2] 1,200	[2] 1,200	(1)	(1)	-------	-------	-------	-------
Italy [2]	74	43	14	12	-------	-------	-------	-------
Japan [3]	1,252	1 613	1.720	650	(4)	-------	-------	-------
New Caledonia	9,415	7,374	8,115	4,328	2.779	3.345	4.882	3,371
Norway	911	577	529	516	55	-------	-------	(1)
Sweden	377	702	698	390	-------	-------	-------	(1)
Union of South Africa	449	343	481	499	497	529	458	618
U. S. S. R.[2]	11,000	11,160	13,000	13,400	20,000	25,000	25,000	25,000
United States [5]	555	582	896	1,048	319	586	801	717
Total (estimate)	158,000	167,000	157,000	145,000	123,000	140,000	151,000	146,000

1 Data not available; estimate by author of chapter included in total.
2 Estimate.
3 Preliminary data for year ended Mar. 31 of year following that stated.
4 Less than 1 ton.
5 Byproduct in electrolytic refining of copper. In 1944 and 1945 includes also production from ore.

Brazil.—According to the Mining Journal:[2]

> The important deposit of nickel at San José de Tocantins is being worked by the Empressa Comercial de Goias S. A. The ore shows an average content of 12 to 13 percent. It is now conveyed by road to Anapolis, 130 miles south, and thence by rail to Santos, a distance of 804 miles. Within the Jacuba, Forquilha, and Cachimbo area a visible reserve of more than 2,000,000 tons has been found, most of it with a 5-percent nickel content. Due to the high transportation costs the National Department of Mineral Production suggests building local mills for the preparation of ferronickel with a 75-percent nickel content. Exports of nickel from Brazil to Germany exceeded 4,000 tons annually before the war.

Canada.—Virtually all the Canadian nickel output is derived from the copper-nickel ores of the Sudbury district, Ontario. Some nickel is also recovered as a byproduct from silver-cobalt ores of cobalt. Two companies—International Nickel Co. of Canada, Ltd., and Falconbridge Nickel Mines, Ltd.—are the principal producers. Nickel production in Canada was 128,328 short tons in 1949 compared with 131,740 tons in 1948. Exports of nickel from Canada were 127,141 short tons in 1949 compared with 131,840 tons in 1948.

Sales of nickel in all forms by the International Nickel Co. of Canada, Ltd., were 209,292,257 pounds in 1949 compared with 240,098,274 pounds in 1948.[3] The 13-percent decline in sales was caused by inventory adjustments by consuming industries, work stoppages in the steel mills, and uncertainties in the business outlook

2 Mining Journal (London), vol. 234, No. 5978, Mar. 17, 1950, p. 258.
3 International Nickel Co. of Canada, Ltd., Annual Report: 1949, 16 pp.

in the United States. About 85 percent of the 1949 total was sold in the United States, Great Britain, and Canada.

Ore mined was 9,984,891 short tons in 1949 compared with 10,866,-862 tons in 1948. Underground development in the operating mines totaled 84,654 feet in 1949, bringing the total footage to 1,408,314 or over 266 miles. Proved ore reserves at the end of 1949 were 251,805,-000 short tons containing 7,630,000 tons of nickel-copper compared with 246,177,000 tons containing 7,503,000 tons of nickel-copper at the end of 1948.

Concerning developments in 1949, the company reported as follows:

> The year was marked by much activity in preparing our underground mines for greater production of ore to compensate for the nearing completion of our working of the low-grade Frood-Stobie open pits. The No. 2 Shaft at the Murray Mine is being deepened from the 1500 level to the 3450 level and sinking is proceeding on a three-shift basis. At the Levack Mine, preparatory work has been done for deepening the No. 2 Shaft approximately 1,050 feet. Excavation is also under way at Levack for an internal shaft with necessary permanent hoist and headframe installations. Development from the No. 2 Shaft at Garson Mine was continued at all levels below the 2000 level. At the Frood-Stobie Mine, further progress was made on development from the No. 7 Shaft and in the areas immediately below the bottom of the open pits which are to be mined from underground.
>
> Satisfactory progress has been made on the project for the mining of lower grade ores from the Creighton Mine. A new No. 7 Creighton Shaft is being sunk to a depth of approximately 2,000 feet and a new Concentrator under construction at the mine site is scheduled to be completed by 1951. The foundations for the building to house the Crushing Plant and Mill have been completed. The Concentrator will have a capacity of 6,000 tons per day and will supply the concentrate by pipe line to Copper Cliff, a distance of approximately 7½ miles.

The change-over from the Orford process to the new matte flotation process for the separation of nickel and copper was completed in July 1949. The entire output of the company's nickel is now handled by this new process.

Falconbridge Nickel Mines, Ltd.,[4] reported that its mine, smelter, and refinery production reached new peaks in 1949, but sales were slightly below 1948. Ore treated was 941,929 short tons in 1949 compared with 821,259 tons in 1948. Although refinery production was 18 percent greater than in 1948, it did not pace smelter production, and as a consequence inventory of matte increased. However, the program underway at the refinery at Kristiansand, Norway, will increase capacity sufficiently to handle the accumulated surplus of matte. At the Falconbridge mine, which produced 921,916 short tons of ore in 1949, the internal shaft reached a depth of 4,000 feet at the year end; stations were established at 175-foot intervals, and loading pockets for development work were completed and collared. At the McKim mine, which yielded 15,896 tons of ore, preproduction development made good progress in 1949, and tonnages and grades of ore indicated by diamond drilling have been proved by drifting on four upper levels. The ore-pass system to the 1300 loading pocket was completed, and a ventilation-escapement raise was driven from the 300 level to surface and was being extended to lower levels. The Bexora nickel prospect was thoroughly tested during a 6-month period, but no commercial ore bodies were found and the option was dropped. Field parties were active in southern Manitoba and in

[4] Falconbridge Nickel Mines, Ltd., 21st Annual Report: 1949, 18 pp.

Ontario. At the year end three properties were under option for investigations in 1950. Ore reserves of the company totaled 14,791,000 short tons on December 31, 1949, and comprised 8,592,000 tons of developed ore averaging 1.62 percent nickel in the Falconbridge and McKim mines and 6,199,000 tons of indicated ore averaging 1.86 percent nickel in Sudbury district holdings.

The Sherritt Gordon Mines, Ltd.,[5] continued its program of exploration and development of nickel-copper ores in the Lynn Lake area of northern Manitoba in 1949. Sinking of the "A" shaft was completed, and a pilot mill of 50 tons daily capacity was built. At the end of 1949 the ore reserves were calculated at 10,365,000 tons averaging 1.443 percent nickel and 0.681 percent copper, which, according to the company, is sufficient to support a 2,000-ton-per-day operation for about 15 years. The results of the pilot-mill operation at Lynn Lake and of the pilot leaching plant operation at Ottawa exceeded expectations. In 1949, 288 tons of concentrates were produced from 2,245 tons of ore milled; and over 100 tons of concentrates were shipped to Ottawa.

Chile.[6]—Nickel deposits have been discovered near Concepcion, about 250 miles south of Santiago, and work was in progress to determine the size and value of the deposit.

Indonesia.—According to Metal Bulletin: [7]

> Exploration for nickel ores by N. V. Mijnbouw Mattschappij Celebes has been making steady progress. Contact has been established with a foreign group which examined samples of the ores. These examinations have yielded results satisfactory in every way.

New Caledonia.—The Pin-Pin concession at Moindah, 130 miles north of Noumea, and the Thio Group at Thio, on the east coast, both belonging to La Société le Nickel, were the only nickel properties in production in 1949. However, the Pin-Pin concession discontinued operation in April. Output of ore was 93,870 metric tons and comprised 91,730 tons averaging 3.5 percent nickel at the Thio Group and 2,140 tons averaging 7.5 percent nickel at the Pin-Pin concession. Output of ore in 1949 was inadequate to pace consumption; as a consequence, only one blast furnace, one electric furnace, and two Bessemer converters were operated.

Production of matte was 3,950 metric tons averaging 77 percent nickel in 1949 (2,208 tons in 1948).

Production of ferronickel was 1,936 metric tons averaging 37 percent nickel in 1949 (4,049 tons in 1948).

La Société le Nickel expected to receive much heavy mining and conveying equipment from the United States under Economic Cooperation Administration allotments to triple mine-extraction rates.

Norway.[8]—Operating conditions in 1949 at the Falconbridge nickel refinery at Kristiansand, with respect to power, materials, and supplies, showed a marked improvement over previous years, but the shortage of skilled labor continued and was particularly acute during the summer. Moreover, the modernization program involving the addition of buildings and equipment to the existing plant interfered

[5] Sherritt Gordon Mines, Ltd., Annual Report: 1949, 20 pp.
[6] Metal Bulletin (London), No. 3434, Oct. 18, 1949, p. 16.
[7] Metal Bulletin (London), No. 3405, July 5, 1949, p. 18.
[8] Falconbridge Nickel Mines, Ltd., 21st Annual Report: 1949, p. 7.

somewhat with production during 1949. Nevertheless, refinery production, at 18 percent above 1948, established a new peak. An active research and development program was continued during 1949, with particular emphasis on the new chloride electrolyte process, cobalt recovery, and quality of special products.

Union of South Africa.—A small quantity (618 metric tons in 1949) of nickel in the form of matte is produced annually in the Rustenburg district, Union of South Africa, by Rustenburg Platinum Mines, Ltd. The matte is exported to England for refining.

United Kingdom.—Nickel production by the Mond Nickel Co. at the refinery at Clydach, Wales, was 49,400,000 pounds in 1949 compared with 39,800,000 pounds in 1948.

Nitrogen Compounds

By Bertrand L. Johnson

GENERAL SUMMARY

THE United States—the largest producer and importer of nitrogen in the world—was still experiencing a shortage of nitrogen when 1949 opened. During much of the year supplies of nitrogenous fertilizer were inadequate for agricultural use. Later, conditions improved, and toward the end of the year the supply and demand were reported balanced. Temporarily, at least, existing facilities could supply the present and the probable future demands for nitrogen, provided that war does not increase the need for a further munition supply and thereby curtail quantities available for agricultural use.

There were no Government controls over the distribution of nitrogenous fertilizers by private producers for use in domestic agriculture. Exports were allocated during the first half of 1949 through the Food and Agriculture Organization of the United Nations, and export quotas were maintained during much of the balance of the year after the allocation by the International Emergency Food Committee stopped June 30, 1949.

Laws enacted by Congress in 1948 required the Army to supply 50 percent of the export requirements of the United States in the nonoccupied areas under the IEFC nitrogen-allocation program and also to make available 10 percent of its anhydrous ammonia production to domestic ammonium sulfate producers facing shut-down because of lack of material. Both of these laws were repealed by Congress September 29, 1949.

Ammonia solutions (including liquid anhydrous ammonia), ammonium sulfate, ammonium nitrate, and synthetic sodium nitrate form the principal part of our domestic production of nitrogen compounds. Little industrial chemical nitrogen is imported, but large quantities of nitrogenous fertilizer materials enter the United States each year. Export fertilizer nitrogen is mostly in the form of ammonium sulfate and ammonium nitrate, large quantities of which are shipped abroad. Much smaller tonnages of anhydrous ammonia and ammonium nitrate are exported as industrial chemicals.

DOMESTIC PRODUCTION

Ammonium Compounds.—Domestic production of synthetic anhydrous ammonia reached a new high in 1949 of 1,294,057 short tons. Sixteen plants were in operation in 11 States; several of the private plants had considerably increased their productive capacity.

At the beginning of 1949 the Army had remaining in its possession two operating anhydrous ammonia plants—the Morgantown Ordnance Works, Morgantown, W. Va., and the Ohio River Ordnance Works,

West Henderson, Ky.—and two lines of anhydrous-ammonia production equipment of the Louisiana Ordnance Works, Louisiana, Mo., which were later erected at the San Jacinto Ordnance Depot, near Houston, Tex. This work was completed late in 1949, and operation of the first unit was begun about the first of 1950. The Army also had an option on the entire production of the Cactus plant at Etter, Tex., to meet its need for nitrogen in occupied areas. Later in the year it released the output of this plant from export requirements. At the end of 1949 the Army was planning to close its three synthetic ammonia plants, as adequate quantities to meet its fertilizer requirements in Japan and Korea were available from private industry.

Nitrogen compounds produced in the United States, 1946–49, in short tons

	1946	1947	1948	1949
Ammonia (NH_3):				
Synthetic plants: Anhydrous ammonia [1]	725,537	[2] 1,114,000	1,089,786	1,294,057
Byproduct coking plants (NH_3 content):				
Aqua ammonia	24,991	25,718	24,753	22,750
Ammonium sulfate	160,938	202,360	207,671	189,202
Total	185,929	228,078	232,424	211,952
Ammonium sulfate:				
Synthetic plants [1]	156,653	[2] 195,848	[2] 264,476	846,195
Byproduct coking plants [3]	643,752	809,440	830,683	756,807
Total	800,405	[2] 1,005,288	[2] 1,095,159	1,603,002
Ammonium nitrate, basis solution 100 percent NH_4NO_3 [1]	724,899	[2] 1,086,869	988,342	1,018,706

[1] Data from Bureau of the Census monthly Facts for Industry series.
[2] Revised figure.
[3] Does not include ammonium sulfate produced at byproduct coking plants from purchased anhydrous ammonia as follows: 1946 (no data); 1947—11,070 short tons; 1948—30,749 short tons; 1949—58,826 short tons

The total production of ammonium sulfate from both synthetic and byproduct sources jumped more than half a million tons in 1949 to 1,603,002 short tons, an increase of 46 percent, owing to a marked increase in the production of synthetic ammonium sulfate.

Production of byproduct coke-oven ammonium sulfate was cut down in 1949 to 756,807 short tons from 830,683 tons in 1948, because of a strike in the domestic steel industry, but reportedly without causing serious damage to the fertilizer mixers during the mill shut-down.

Within the past year or so, a number of plants have been built to produce synthetic sulfate of ammonia from anhydrous ammonia; and there has been a large and increasing production of this material, the output of which in 1949 was greater than that of byproduct coke-oven ammonium sulfate. Synthetic ammonium sulfate technical was produced in 15 plants in 7 States and in 5 coke-oven plants manufacturing ammonium sulfate from purchased synthetic anhydrous ammonia. The production rose from 264,476 short tons in 1948 to 846,195 tons in 1949, an increase of 220 percent. The continued increase in supplies of synthetic sulfate of ammonia will tend to reduce the dependency of the fertilizer industry on coke-oven products.

The Government-owned wartime experimental plant at Salem, Oreg., built originally for the production of alumina from clay, and now available for sale, was operated by Columbia Metals Corp. for the production of synthetic ammonium sulfate during part of the first half of 1949, on an interim lease expiring June 30, 1949. It was then turned back to the Real Property Disposal Division (formerly War Assets Administration) of General Services Administration.

The postwar conversion to fertilizer production of synthetic ammonia plants built for war purposes made possible a notable increase in the output of ammonium nitrate. The synthetic ammonia is first oxidized to nitric acid, which is then neutralized with ammonia to produce ammonium nitrate. In 1949 the production of this material rose to 1,018,706 short tons from 988,342 tons in 1948, but still was 68,163 tons below the 1947 high. Ammonium nitrate of fertilizer grade was produced in 6 plants in 6 States. Ammonium nitrate of other grades came from 23 plants in 13 States.

Sodium Nitrate.—The synthetic nitrate of soda consumed in the United States in 1949 was produced domestically. None of the synthetic is known to have been imported. Before 1949 the only regular commercial producer was the Solvay Process Division, Allied Chemical & Dye Corp., which manufactured it at its Hopewell, Va., plant and marketed it under the brand name "Arcadian." Another producer entered the field in 1949—the Mathieson Chemical Corp. This company began producing synthetic nitrate of soda at its Lake Charles, La., plant in October 1949, using anhydrous ammonia and soda ash as raw materials.

The domestic output of synthetic sodium nitrate in 1949 is reported to have been produced at a rate double that of 1948. The export program was said to have taken 3 percent of the production. The increased production and a drop in demand from the glass and chemical trades made more material available for fertilizer.

Deposits of soluble nitrate minerals, none of present economic importance, are scattered throughout the United States. (See Minerals Yearbook 1942, p. 1522.)

CONSUMPTION AND USES

Anhydrous ammonia and solutions—the leading forms of nitrogen for fertilizer purposes—supply over 30 percent of all nitrogen consumed in agricultural fertilizers. The use of liquid ammonia as a source of nitrogen has been increasing; in 1947 it is reported to have totaled—in the United States—about 35,000 tons, slightly more than 4 percent of all chemical nitrogen used in this country.

Ammonium sulfate supplying a little over 20 percent of the fertilizer nitrogen stands second as a source of nitrogen for nitrogenous fertilizers. Both the "converted" type made from byproduct ammonia from coke-oven distillation and that made from purchased synthetic ammonia are employed, principally in mixed fertilizers, only a small percentage being utilized for direct application. While coke-oven sulfate of ammonia production was low during the steel strike in 1949,

the demand from the mixers is also reported to have slowed owing to an accumulation of mixed fertilizers.

Ammonium nitrate was first employed in mixed fertilizers about 1930 and was first applied as a top dressing in the 1942–43 season. For the year ended June 30, 1950, the United States Department of Agriculture estimated that 430,000 short tons, with a nitrogen content of 142,000 tons, were used in agriculture. Consumption in recent years is thus seen to have increased rapidly, and ammonium nitrate now ranks third in the United States as a source of fertilizer nitrogen, furnishing over 15 percent of the total fertilizer nitrogen consumed in 1949 in the United States.

The balance of fertilizer nitrogen comes from sodium nitrate, calcium cyanamide, some miscellaneous products, and natural organics.

An increasing demand is reported for anhydrous ammonia and its compounds for industrial use in the production of plastics and synthetic fibers and for refrigeration, as well as for the production of urea. The latter compound is in demand, not only for fertilizer, but also for animal feeds and plastics.

PRICES

Chilean Nitrate.—The base rate for imported Chilean nitrate of soda at the usual ports of importation throughout most of December 1948 was $48 per ton for the bulk product and $51.50 per ton for the bagged material. On December 31, 1948, the prices were advanced $3 per ton, bringing the price for the bulk product to $51 per ton and for the bagged nitrate to $54.50 per ton of 2,000 pounds. These prices are for shipment in carlots, f. o. b. cars at the port warehouse from which delivery is made. In October 1949, Chilean nitrate prices were reduced $3 per ton to the prices prevailing during the latter part of the previous year—$48 per ton for bulk and $51.50 for bagged material—reportedly because of competition from synthetic nitrate. These prices were in effect the balance of the year.

Synthetic Nitrate.—Prices for domestic synthetic nitrate of soda, crude, carlots, works, as quoted in Oil, Paint and Drug Reporter, remained throughout 1949 at the prices effective October 1, 1948—$45 per ton in bulk and $48.50 for the bagged material. The supply position improved during the year. Increased production and decreased demand from the glass and chemical trades is reported to have made more material available for fertilizer. At the end of the year, domestic nitrate is said to have been selling at certain South Atlantic and Gulf ports at prices competitive with imported nitrate.

FOREIGN TRADE [1]

Large amounts of natural sodium nitrate from Chile enter the United States each year, the quantity greatly exceeding the tonnage of any other nitrogenous material. The domestic demand for Chilean sodium nitrate, as indicated by the imports, declined in 1949 from 1948 but did not recede to the levels of 1946 and 1947. The

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

quantity imported fell from 709,573 short tons in 1948 to 675,543 tons in 1949. The total value of the imports in 1949, however, exceeded the record made in 1948, reaching a new high level of $26,006,053.

Early in 1949 the domestic demand for natural Chilean nitrate was greater than the supply, there were no stocks on hand, and the market position was tight. By June the supply position had improved appreciably, and by August stocks had accumulated, meeting requirements without difficulty. Supplies were no longer a problem. For the balance of the year stocks remained ample to meet requirements.

Small, irregular imports of Chilean sodium-potassium nitrate into the United States have been the rule in recent years. In 1948 there were no known imports; but in 1949 they suddenly jumped to 6,802 short tons, valued at $310,343.

Major nitrogen compounds imported into and exported from the United States, 1946–49, in short tons

[U. S. Department of Commerce]

	1946	1947	1948	1949
Imports:				
Industrial chemicals:				
Ammonium nitrate	-----	27	80	1
Anhydrous ammonia	7	-----	209	-----
Fertilizer materials:				
Ammonium nitrate mixtures:				
Containing less than 20 percent nitrogen	-----	92	250	2,290
Containing 20 percent or more nitrogen	1,105	99,322	100,314	136,405
Ammonium phosphates	91,113	105,189	108,228	126,274
Ammonium sulfate	101,558	114,398	105,887	105,498
Calcium cyanamide	163,093	153,764	116,504	115,885
Nitrogenous materials, n. s. p. f.	126,029	9,687	5,304	4,829
Potassium nitrate, crude	-----	(1)	(1)	1
Sodium nitrate	[2] 540,870	556,525	[2] 709,573	675,543
Sodium-potassium nitrate	4,400	2,500	-----	6,802
Exports:				
Industrial chemicals:				
Anhydrous ammonia	6,159	6,062	3,407	3,929
Ammonium nitrate	[2] 6,972	[2] 6,685	[2] 5,087	17,004
Fertilizer materials:				
Ammonium nitrate	(3)	(3)	(3)	470,443
Ammonium sulfate	25,256	88,601	[2] 136,648	660,733
Nitrogenous chemical materials, n. e. s.	[2] 117,375	[2] 153,607	[2] 701,450	23,510
Sodium nitrate	16,180	19,920	17,100	3,714

[1] Less than 1 ton.
[2] Revised figure.
[3] Not separately classified 1946–48, inclusive; included in nitrogenous chemical materials, n. e. s.

Sodium nitrate and sodium-potassium nitrate imported for consumption in the United States, 1945–49 [1]

[U. S. Department of Commerce]

Year	Sodium nitrate		Sodium-potassium nitrate	
	Short tons	Value	Short tons	Value
1945	849,888	$18,558,959	-----	-----
1946	[2] 540,870	[2] 11,681,235	4,400	$146,312
1947	556,525	15,153,889	2,500	64,968
1948	[2] 709,573	[2] $23,042,302	-----	-----
1949	675,543	26,006,053	6,802	$310,343

[1] All from Chile except sodium nitrate from Canada as follows: 1947: 42 tons, $2,542; 1948: 199 tons, $11,057; 1949: 8 tons, $416.
[2] Revised figure.

In July 1949 the Office of International Trade, United States Department of Commerce, announced that an export quota permitting shipments of nitrogenous fertilizer containing up to 52,000 short tons of nitrogen had been established for the fiscal year July 1949 through June 1950. No country quotas were announced. This was 10,000 tons less than that for the previous fiscal year because of increases in nitrogenous fertilizer production in some foreign countries. On September 23 a supplemental quota of 30,000 tons was announced, raising the total amount of nitrogen that could be exported in the form of fertilizers during the fiscal year ended June 30, 1950, to 82,000 tons. On November 23, 1949, another supplemental quota was announced, permitting additional exports up to 25,000 tons of nitrogen, shipments to be made before January 25, 1950. These supplemental quotas were established to relieve members of the nitrogenous fertilizer industry who had surplus stocks on hand. On December 5, 1949, OIT announced removal of all quantitative quotas from exports of most nitrogenous fertilizer materials made before January 25, 1950. This relaxation of export controls was made possible by increased domestic supplies of nitrogenous fertilizers. Controls on ammonium nitrate and materials containing ammonium nitrate were, however, retained because of the possibility that these materials might be used for munitions making, and licenses were required for exporting these materials.

WORLD REVIEW

The world-wide shortage of nitrogen prevalent after World War II continued into 1949; but during the year the nitrogen situation became more favorable, and at the end of 1949 the world nitrogen shortage was apparently over. During most of the year there had been inadequate supplies of nitrogen for agricultural use. At the close, however, the productive capacity for fertilizer nitrogen products exceeded the prospective demand for the immediate future on the basis of normal peacetime demands, but the supply would not be adequate in a wartime economy.

Control of world nitrogen exports continued, in the first half of 1949, under the auspices of the Food and Agriculture Organization of the United Nations. This international allocation of nitrogen fertilizers from exporting countries was discontinued June 30, 1949. Since then, exporting countries have been entitled to sell to any importing country, and importing countries have been free to buy from any exporting country. United States export controls, however, were retained.

World nitrogen supplies (excluding U. S. S. R.) for the 1949–50 year have been estimated by Aikman (London), Ltd., at 3,599,000 metric tons of agricultural nitrogen and 575,000 tons for industry. The Food and Agriculture Organization of the United Nations early in 1950 estimated 3,310,900 metric tons for the production of fertilizer nitrogen in 1948–49 and 3,737,990 tons in 1949–50.

World production and consumption of fertilizer nitrogen compounds, by principal countries, fiscal years, 1948–50, in metric tons of contained nitrogen

[United Nations Food and Agriculture Organization]

Country	Production			Consumption		
	1947–48	1948–49	1949–50 [1]	1947–48	1948–49	1949–50 [1]
Austria	43,500	59,000	66,000	20,500	19,600	20,500
Belgium	146,520	152,130	160,000	89,000	72,600	75,000
Canada	160,570	175,420	180,680	24,680	31,720	32,820
Chile	274,080	275,270	277,250	6,080	8,140	8,140
China (Formosa only)					20,710	39,310
Denmark				39,670	45,400	59,000
Egypt				64,890	76,000	109,000
France [2]	169,700	187,500	214,000	236,820	224,000	225,000
Germany:						
Federal Republic	230,000	327,600	426,000	311,120	335,540	310,000
Soviet Zone	120,000	110,000	130,000	120,000	110,000	130,000
India	7,280	12,630	10,900	35,930	49,150	114,060
Italy	100,000	104,330	130,000	99,300	109,930	125,000
Japan	200,520	274,070	343,420	310,460	300,000	411,000
Korea:						
North	10,000	20,000	30,000	5,000	5,000	10,000
South				73,200	75,000	100,000
Netherlands	65,000	86,080	120,000	103,320	116,500	140,000
Norway	82,850	107,500	148,020	20,400	25,220	39,000
Poland	41,140	55,080	60,000	42,060	58,440	70,000
United Kingdom [2]	258,000	280,800	271,250	184,800	187,600	198,100
United States [2]	905,260	975,000	1,050,000	805,590	915,000	935,000
Other countries	103,410	108,490	120,470	328,030	337,690	397,640
Total [3]	2,917,830	3,310,900	3,737,990	2,920,850	3,123,240	3,548,570

[1] Preliminary figures.
[2] Figures for consumption include overseas territories.
[3] Exclusive of U. S. S. R.

Chile.—A new process of nitrate recovery—the Lesesne "butterfly" process—which is reported to recover 95 percent of the nitrate in the crude ore, was successfully operated on a pilot-plant scale in Chile by the Compania Salitrera de Tarapaca y Antofagasta and in February 1950 was placed in commercial operation at that company's Mapocho plant. This process employs a solar evaporation technique, as does the Guggenheim method, but differs from the latter in that it does not utilize ponds. The name of the process is derived from the butterflylike appearance of the sprinkling assembly of nozzles and supports mounted on a railroad tank car. The nitrate solution is sprayed on the ground, where it evaporates, leaving a thin coating of the salts. The deposit is harvested when it has reached a thickness of about 2½ inches. The yield is not pure sodium nitrate but a concentrated mixture of salts that has to be further refined for the fertilizer market.

The nitrate plant of the Compania Salitrera Iquique at Taltal, Chile, is reported to have been reopened in 1949 after having been closed for 15 years.

Peat

By J. A. Corgan and Golden V. Chiriaco

GENERAL SUMMARY

LITTLE change characterized the statistical picture of the peat industry in the United States in 1949 compared with 1948. Production totaled 129,532 short tons in 1949, a decline of less than 1 percent from the 129,581 tons produced in 1948. The average value per ton in 1949 showed a 10-percent increase over that in 1948. No exports of peat were reported for 1949. Imports increased about 4 percent over 1948 and accounted for about 42 percent of the total quantity consumed in this country in 1949.

In March 1949 a general conference was called by the Federal Trade Commission in Washington to set up trade-practice rules for the peat industry. Proposed rules were issued in September, after which several hearings were held, whereby all interested or affected parties, including peat operators, were given an opportunity to be heard. One of the controversial issues was the proper application of the terms "moss peat" and "peat moss" to a particular kind of peat. After full consideration of the facts submitted, the Federal Trade Commission promulgated, on January 13, 1950, a set of rules designed to foster and promote the maintenance of fair competitive conditions to protect the peat industry, trade, and the public. A copy of the rules may be obtained by writing to the Federal Trade Commission, Washington 25, D. C.

In March 1950, a bill was introduced in the Senate, which, if enacted, will authorize the United States Department of the Interior to survey the possibility of using peat and its related byproducts to increase our energy supply, thereby aiding in the conservation of fuel resources.

RESERVES

Peat occurs in about half of the States. An estimate of 13,827,000,000 short tons has been calculated as air-dried peat.[1] Minnesota, Wisconsin, and Michigan combined contain 75 percent of the reserves; 14 percent of the country's total is in Florida; and the rest is distributed through the New England and Pacific Coast States.

PRODUCTION

Peat production in the United States in 1949 totaled 129,532 short tons, a decline of less than 1 percent from the 129,581 tons produced in 1948. The peat produced in 1949 was valued at $1,020,014, compared with a total value of $929,560, recorded for 1948.

Forty-eight producers operating in 19 States accounted for the 1949 output. Although nine plants that produced peat in 1948 were inactive in 1949, this loss in production was compensated by the output from several plants that resumed production in 1949 after a year or two of inactivity.

[1] Soper, E. K., and Osbon, C. C., The Occurrence and Uses of Peat in the United States: U. S. Geol. Survey Bull. 728, 1922, p. 92.

The average value per ton in 1949 was $7.87, a 10-percent increase over the 1948 value of $7.17.

Peat produced in the United States, 1945–49

Year	Short tons	Value	
		Total	Per ton
1945 (estimated)	107,000	$821,000	$7.67
1946	140,707	1,006,231	7.15
1947	136,232	868,979	6.38
1948	129,581	929,560	7.17
1949	129,532	1,020,014	7.87

New Jersey was the largest peat-producing State in 1949, followed, in order of output, by Ohio, Minnesota, Florida, Michigan, Indiana, Illinois, Pennsylvania, Connecticut, California, Maine, Colorado, Wisconsin, Iowa, Georgia, Texas, Washington, Massachusetts, and New Hampshire.

About 60 percent of the total output in 1949 was designated as peat humus and was produced in 14 States. Reed or sedge peat, produced in 12 States, comprised about 32 percent; and moss peat and other, produced in 7 States, about 8 percent.

Peat produced in the United States, by States, 1947–49

State	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			2,034	$11,620		
California	3,431	$22,209	6,942	33,265	5,670	$35,193
Colorado	(1)	(1)	(1)	(1)	2,800	24,504
Connecticut	5,061	25,705	4,332	24,124	5,974	33,011
Florida	42,300	126,000	24,750	56,171	11,800	69,000
Georgia	2,400	48,000	2,500	50,000	1,870	56,000
Indiana	3,957	14,760	2,288	11,576	7,949	28,537
Maine	2,647	72,875	1,100	29,699	3,312	79,360
Massachusetts	820	11,000	441	6,188	595	7,415
Michigan	5,013	60,218	12,425	154,500	(1)	(1)
Minnesota	7,000	36,000	3,000	12,900	12,820	54,255
New Hampshire					15	296
New Jersey	21,640	135,300	23,102	163,056	25,500	180,750
New York	(1)	(1)				
Ohio	17,754	143,247	19,207	162,073	20,372	181,117
Pennsylvania	(1)	(1)	(1)	(1)	6,663	30,035
Texas	(1)	(1)	1,334	19,028	1,531	12,000
Washington	2,425	10,125	(1)	(1)	(1)	(1)
Other States [2]	21,784	163,540	26,126	195,360	22,661	228,541
Total	136,232	868,979	129,581	929,560	129,532	1,020,014

[1] Included with "Other States."
[2] Illinois, Iowa, Wisconsin, and States indicated by footnote 1.

Peat produced in the United States, 1948–49, by kinds

Kind	1948			1949		
	Short tons	Value		Short tons	Value	
		Total	Per ton		Total	Per ton
Moss peat	12,685	$128,960	$10.17	10,150	$149,531	$14.73
Reed or sedge	27,566	262,475	9.52	40,945	260,939	6.37
Peat humus	88,949	536,993	6.04	78,036	608,626	7.80
Other	381	1,132	2.97	401	918	2.29
Total	129,581	929,560	7.17	129,532	1,020,014	7.87

USES

For many years peat has been used in this country principally for soil improvement. Of the total sales reported for 1949, 59 percent was used for this purpose, 32 percent for mixed fertilizers, and 9 percent for other purposes, including litter for poultry yards, for golf greens, in nurseries and greenhouses, for landscape plantings, etc.

Although some European countries utilize peat for fuel and power purposes, it has not been used generally in this country for fuel purposes because of ample supplies of higher-grade fuels at competitive prices.

Peat sold in the United States in 1946–49, by uses

Year	Soil improvement		Mixed fertilizers		Other uses		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1946	99,733	$664,565	32,471	$263,542	6,684	$66,286	138,888	$994,393
1947	105,796	584,012	28,354	266,359	1,561	17,593	135,711	867,964
1948	86,991	578,615	36,012	309,259	6,000	36,000	129,003	923,874
1949	76,963	546,062	40,897	385,015	11,672	89,237	129,532	1,020,314

United States Government Specifications.—The Federal Government purchases a certain amount of peat, provided it meets required specifications. These specifications may be obtained from the Federal Supply Service, General Services Administration, Washington 25, D. C.

IMPORTS[2]

Imports of peat totaled 94,747 short tons in 1949, an increase of 21 percent over the 1939 prewar figure of 78,611 tons and 4 percent more than the quantity imported in 1948 (91,073 short tons). No exports of peat were reported; consequently, the quantity available for domestic consumption in 1949 totaled 224,279 tons.

[2] Figures on imports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Peat moss imported for consumption in the United States, 1945–49

[U. S. Department of Commerce

Year	Short tons	Value	Year	Short tons	Value
1945	77,673	$2,393,214	1948	91,073	$3,194,656
1946	84,078	2,704,803	1949	94,747	3,184,409
1947	79,567	2,698,622			

Peat moss imported for consumption in the United States, 1947–49, by kinds and by countries

[U. S. Department of Commerce]

Country	Poultry and stable grade					
	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada	33,647	$1,239,459	31,328	$1,130,686	25,473	$890,230
Denmark	67	1,434	25	830	32	838
Germany			23	587	1,646	43,177
Ireland			63	2,207	424	19,260
Netherlands	280	7,253	70	2,049	474	12,622
Norway	1	30				
Poland-Danzig					122	3,900
Sweden	6	283	1	49	16	464
United Kingdom			55	1,846	10	420
Total	34,001	1,248,459	31,565	1,138,254	28,197	970,911

Country	Fertilizer grade					
	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Belgium-Luxembourg					55	$710
Canada	43,377	$1,391,074	54,700	$1,928,087	48,162	1,651,913
Denmark	72	1,984	488	15,856	1,145	31,909
Germany	75	1,867	334	7,583	5,306	136,045
Ireland	22	750	668	25,797	2,734	109,692
Netherlands	1,990	53,733	2,555	52,409	5,894	154,593
Norway					2	51
Poland-Danzig	(1)	26	512	18,385	2,735	106,351
Sweden			19	733	367	17,541
United Kingdom	30	729	232	7,552	150	4,693
Total	45,566	1,450,163	59,508	2,056,402	66,550	2,213,498

[1] Less than 1 ton.

WORLD PRODUCTION

The latest available statistics on the world production of peat are given in the accompanying table.

World production of peat, by countries, 1943–49, in metric tons [1]

[Compiled by Pauline Roberts]

Country	1943	1944	1945	1946	1947	1948	1949
Canada:							
Fuel	709	584	107	132	86	77	51
Peat moss	58,386	72,979	76,170	87,850	72,592	81,465	56,074
Denmark	6,200,000	5,800,000	5,684,723	3,705,180	5,168,139	3,616,860	1,416,000
Finland	2,364	2,840	7,280	6,846	12,192	8,277	(2)
France	190,210	112,619	95,842	84,621	57,995	(2)	(2)
Germany	[3] 640,000	(2)	[3, 4] 20,000	[3, 5] 500,000	[5] 1,800,000	[5] 2,038,000	[4] 1,155,000
Hungary	28,640	(2 6)	(2 6)	3,720	8,550	(2)	(2)
Iceland	11,560	11,973	11,000	[3] 10,500	3,200	(2)	(2)
Ireland	4,954,895	5,302,477	5,086,734	4,826,238	4,850,512	[3] 3,846,800	(2)
Italy	167,904	72,152	156,069	(2)	(2)	(2)	(2)
Netherlands	648,800	535,550	386,050	571,940	(2)	(2)	(2)
Norway	334,688	296,974	269,648	(2)	378,600	343,130	(2)
Portugal	(2)	1,490	2,322	2,456	2,715	1,502	266
Sweden:							
Fuel	978,269	774,612	1,049,089	770,230	436,249		
Litter, baled	110,000	105,310	101,420	68,513	72,473		
Litter and "Mull," unbaled	1,395	1,303	1,075	964	3,246	375,000	(2)
"Mull," baled	15,948	16,600	14,629	9,862	12,486		
Switzerland	[3] [illegible]	[3] 310,000	497,429	100,000	40,000	(7)	(2)
United States [8]	54,000	88,000	97,000	127,647	123,587	117,553	117,509
Total (estimate)	14,830,000	14,026,000	13,660,000	11,327,000	13,693,000	11,180,000	9,000,000

[1] In addition to countries listed, Argentina, Australia, Poland, and U. S. S. R. produce peat, but data of production are not available; estimates for these are not included in total. U. S. S. R. produced approximately 20,000,000 tons in 1945.
[2] Data not available; estimate included in total.
[3] Estimate.
[4] American zone only.
[5] Bizonal area.
[6] Data represent Trianon Hungary after October 1944.
[7] Negligible.
[8] Data for 1943 are as reported to the Bureau of Mines by producers and probably represent only about ⅔ of total production. Data for 1944–49 believed to represent reasonably complete coverage.

Petroleum and Petroleum Products

By A. G. White, G. W. Cale, A. T. Coumbe, and A. L. Clapp

GENERAL SUMMARY

THE OUTSTANDING feature of the oil situation in 1949 was the sharp downward adjustment of crude production and the volume of refinery operations to meet a small decline in total demand and to secure some liquidation of the excess stocks of refined products on hand at the end of 1948.

The total demand for all oils in 1949 amounted to 2,233.7 million barrels or a daily average of 6,119,000 barrels, a decline of 0.4 percent from 1948. Total exports in 1949 amounted to 119.5 million barrels or 327,000 barrels daily, a decline of 11.1 percent compared with 1948. Domestic demand in continental United States totaled 2,114.2 million barrels in 1949 or 5,792,000 barrels daily, a gain of 0.3 percent. The downward trend in exports may be attributed to the expansion in crude production and refinery capacity abroad and the problem of obtaining dollar exchange to buy American oil products. The almost static domestic demand was, in considerable part, due to abnormal conditions. Unusually mild weather in the first and last quarters of 1949 reduced the demand for heating oils by an amount that may have reduced the total domestic demand for all oils by 2 to 3 percent. A sharp reduction in the volume of industrial operations in the middle of the year cut the demand for heavy fuel oils. The continued rapid expansion in the volume of natural gas marketed reduced the anticipated demand for both oil and coal.

The new supply of all oils in 1949 averaged 6,112,000 barrels daily, a decline of 324,000 barrels daily or 5.0 percent compared with 1948. Most of this decline was due to the difference in stock accumulation in the 2 years. Total stocks of all oils increased by 293,000 barrels daily in 1948, whereas such stocks declined 7,000 barrels daily in 1949. The production of domestic crude oil in 1949 was reduced drastically as every other source of new supply increased materially. Crude production averaged only 5,042,000 barrels daily in 1949, a decline of 478,000 barrels daily or 8.7 percent compared with 1948. The production of natural gasoline and other light oils averaged 428,000 barrels daily, a gain of 26,000 barrels daily or 6.5 percent compared with 1948. Total imports of all oils averaged 642,000 barrels daily in 1949, a gain of 128,000 barrels daily or 24.9 percent compared with 1948. The total demand for foreign and domestic crude oil averaged 5,476,000

barrels daily in 1949, a decline of 5.6 percent compared with 1948, and resulted in a drastic reduction in the volume of refinery operations.

In summary, 1948 represented a year in which the total demand gained 4.1 percent over the previous year and the total supply of all oils was inflated to the extent of adding 107 million barrels to total stocks. In 1949, there was a small decline in total demand due, in considerable part, to abnormal conditions, with new supply and demand in close balance but resulting in a drastic cut in relative crude demand and refinery operations compared with 1948.

TABLE 1.—Demand for all oils in the United States, 1940–49

[Millions of barrels]

Year	Domestic demand	Exports	Total demand	Year	Domestic demand	Exports	Total demand
1940	1,326.6	130.5	1,457.1	1945	1,772.7	183.0	1,955.7
1941	1,485.8	108.8	1,594.6	1946	1,792.8	153.1	1,945.9
1942	1,449.9	116.9	1,566.8	1947	1,989.8	164.5	2,154.3
1943	1,521.4	150.0	1,671.4	1948	2,113.7	134.7	2,248.4
1944	1,671.3	207.6	1,878.9	1949 [1]	2,114.2	119.5	2,233.7

[1] Preliminary figures.

In considering the probable trend of supply and demand in 1950, assuming normal conditions, there should be a substantial relative gain in total demand, including a further downward trend in exports and a considerable gain in domestic demand that might total 6 to 7 percent compared with 1949. About half of this increase represents the assumption of normal conditions in 1950 compared to abnormal conditions in 1949. Although some further liquidation of excess refined stocks seems probable, a materially larger new supply of all oils should be required, with a substantial gain in the volume of refinery operations. The extent of the recovery in the production of domestic crude will depend on the rate of increase in the production of light oils from natural gas and the trend of total imports.

The total production of crude oil declined from 2,020.2 million barrels in 1948 to 1,840.3 million in 1949, a decline of 8.7 percent on a daily average basis. The total decline in production amounted to 179.9 million barrels with Texas accounting for 159.5 million of the total. The average production of Texas decreased from 2,469,000 barrels daily in 1948 to 2,038,000 barrels daily in 1949, a decline of 17.5 percent. The major markets for Texas crude oil are at refineries in Texas and the east coast. The demand for Texas crude oil was affected in 1949 by the decline in exports, the large increase in imports, the unusually mild weather on the east coast, and adjustments for surplus stocks of refined products accumulated in these districts. Total stocks of crude oil increased 26.0 million barrels in 1948 and decreased 3.3 million in 1949. The total demand for crude oil declined from 2,123.3 million barrels in 1948 to 1,998.5 million in 1949, a daily average decline of 5.6 percent, including a decline of 7.5 percent in the demand for domestic crude oil and a gain of 25.1 percent in the demand for foreign crude oil.

Total imports of all oils increased from 188.1 million barrels in 1948 to 234.1 million in 1949, a daily average gain of 24.9 percent. Crude imports rose from 129.1 million barrels in 1948 to 154.9 million in 1949. Imports of refined products, mostly residual fuel oil, rose from 59.0 million barrels in 1948 to 79.2 million in 1949. Imports exceeded exports by 53.4 million barrels in 1948 and 114.6 million in 1949.

The total demand for all oils declined from 2,248.4 million barrels in 1948 to 2,233.7 million in 1949, representing a loss of 14.7 million, including a decline of 15.2 million barrels in exports and a gain of 0.5 million in domestic demand. The principal declines in exports were 9.1 million barrels for distillate fuel oil and 6.7 million for crude oil. The most important changes in domestic demand were a gain of 41.7 million barrels for motor fuel and declines of 12.6 million for distillate fuel oil, 9.5 million for kerosine, 5.2 million for residual fuel oil, and 13.8 million barrels for all other products.

The primary problem resulting from operations in 1948 was the increase of 79.8 million barrels in stocks of refined oils. The temporary oil shortages in the cold winter of 1947–48 furnished an incentive for an early seasonal build-up of stocks of fuel oils, and the subsequent decline in oil demand in the latter half of 1948 contributed to the surplus of stocks at the end of the year. Abnormally mild weather in the first and last quarters of 1949 prevented the reduction of fuel-oil stocks to normal seasonal levels. Total refined stocks were reduced by only 0.8 million barrels in 1949, including a gain of 13.5 million barrels in the California district and a decline of 14.3 million in districts east of California. This surplus stock problem, orginating in 1948, has finally been adjusted by the unexpectedly high demand in the first quarter of 1950 combined with an abnormally low rate of refinery operations.

The expansion in refinery capacity has been sufficient to permit greater flexibility in seasonal operations and better adjustment of product supply to meet unforeseen changes in demand. The total crude-oil capacity of refineries in the United States has risen from 5,569,482 barrels daily on January 1, 1947, to 6,696,300 barrels daily in January 1, 1950.

A brief review of the demand for the major oil products in 1949 should clarify the trends of total demand. The total demand for motor fuel continued the steady upward trend, with large gains in domestic demand to offset the variations in exports. The total demand for motor fuel in 1949 amounted to 952.4 million barrels, including 39.5 million barrels of exports and a domestic demand of 912.9 million. The daily average changes, compared with 1948, indicate a gain of 5.1 percent in total demand, an increase of 5.9 percent in exports, and a gain of 5 percent in domestic demand. Motor fuel was the only major product to show a substantial gain in demand in 1949. The increase in the number of motor vehicles should insure continued gains in demand for several years to come. Mild weather, which reduces fuel-oil demand, generally is favorable to motor transport.

The total demand for residual fuel oil amounted to 508.0 million barrels in 1949, including exports of almost 12.7 million and a domestic demand of 495.3 million barrels. Compared with 1948, on a daily average basis, this was a decline of 0.8 percent in total demand and domestic demand. The demand for residual fuel oil was sustained, in part, by sharp reductions in price early in 1949. The decline of 26.6 million barrels in consumption by railroads and the decrease of 4.7 million barrels in bunker use by ships engaged in the foreign trade was largely offset by the gain of 23.7 million barrels in consumption by public utility electric power plants.

TABLE 2.—Salient statistics of crude petroleum, refined products, and natural gasoline in the United States, 1945–49

	1945	1946	1947	1948	1949 [1]
Crude petroleum:					
Domestic production ..... thousands of barrels [2]	1,713,655	1,733,939	1,856,987	2,020,185	1,840,307
World production ..... do	2,594,798	2,745,474	3,022,075	3,433,021	3,398,400
United States proportion of world production percent	66	63	61	59	54
Imports [3] ..... thousands of barrels [2]	74,337	86,066	97,532	129,093	154,922
Exports [4] ..... do	32,998	42,436	46,355	39,736	33,069
Stocks, end of year:					
Gasoline-bearing crude ..... do	218,763	224,473	224,929	246,572	253,356
California heavy crude ..... do	4,496	5,703	5,725	10,055	
Runs to stills ..... do	1,719,534	1,730,197	1,852,246	2,031,041	1,945,519
Total value of domestic production at wells thousands of dollars	2,094,250	2,442,550	3,577,890	5,245,080	[5]4,667,480
Average price per barrel at wells	$1.22	$1.41	$1.93	$2.60	$2.54
Total producing oil wells in the United States, Dec. 31	415,750	421,460	426,280	437,880	([6])
Total oil wells completed in the United States during year	14,297	15,851	17,999	22,585	22,042
Refined products:					
Imports [4] ..... thousands of barrels [2]	39,282	51,610	61,857	59,051	79,209
Exports [4] ..... do	149,985	110,687	118,122	94,938	86,401
Stocks, end of year ..... do	235,998	271,937	[7] 265,850	[8] 343,537	342,704
Output of motor fuel ..... do	798,194	776,583	839,998	921,923	961,791
Yield of gasoline ..... percent	40.9	39.6	40.2	40.3	43.7
Completed refineries, end of year	393	399	390	375	367
Daily crude oil capacity of refineries thousands of barrels [3]	5,316	5,569	6,034	6,439	6,696
Average dealers' net price (excluding tax) of gasoline in 50 United States cities cents per gallon [9]	10.33	10.40	12.33	14.55	15.05
Natural gasoline:					
Production ..... thousands of barrels [2]	112,004	115,739	132,173	146,221	156,203
Stocks, end of year ..... do	4,322	4,981	4,296	5,579	6,831

[1] Subject to revision.
[2] 42 gallons per barrel.
[3] Bureau of Mines.
[4] Bureau of Mines, 1945–46. U. S. Department of Commerce, 1947–49. Exports include shipments to noncontiguous Territories.
[5] Estimated.
[6] Not available.
[7] Figure on new basis and comparable with succeeding years. Figure for 1947 on old basis and comparable with preceding years—267,103,000 barrels.
[8] Figure on new basis and comparable with succeeding years. Figure for 1948 on old basis and comparable with preceding years—345,650,000 barrels.
[9] American Petroleum Institute.

TABLE 3.—Supply and demand of all oils in the United States in 1948–49, by months

[Thousands of barrels]

	1948													1947 (total)
	January	February	March	April	May	June	July	August	September	October	November	December	Total	
New supply:														
Domestic production:														
Crude petroleum	164, 098	155, 577	167, 868	164, 726	170, 705	166, 448	171, 369	173, 015	163, 244	174, 972	170, 777	177, 386	2, 020, 185	1, 856, 987
Natural gasoline	12, 102	11, 442	12, 373	11, 778	12, 149	11, 624	11, 948	12, 235	11, 616	12, 911	12, 990	13, 553	146, 721	132, 173
Benzol	50	28	28	28	28	28	28	28	28	28	28	28	358	690
Total production	176, 250	167, 047	180, 269	176, 532	182, 882	178, 100	183, 345	185, 278	174, 888	187, 911	183, 795	190, 967	2, 167, 264	1, 989, 850
Imports:														
Crude petroleum [1]	8, 427	8, 354	8, 682	9, 757	10, 293	9, 749	11, 478	10, 883	11, 428	12, 572	12, 923	14, 547	129, 093	97, 532
Refined products [2]	5, 479	6, 286	6, 098	5, 048	4, 714	4, 011	4, 425	4, 622	4, 402	3, 876	4, 555	5, 535	59, 051	61, 857
Total new supply	190, 156	181, 687	195, 049	191, 337	197, 889	191, 860	199, 248	200, 783	190, 718	204, 359	201, 273	211, 049	2, 355, 408	2, 149, 239
Change in stocks	−10, 029	−575	+1, 275	+8, 068	+13, 722	+10, 358	+14, 040	+14, 935	+15, 290	+19, 636	+15, 553	+4, 783	+107, 056	−5, 041
Demand:														
Total demand	200, 185	182, 262	193, 774	183, 269	184, 167	181, 502	185, 208	185, 848	175, 428	184, 723	185, 720	206, 266	2, 248, 352	2, 154, 280
Exports: [3]														
Crude petroleum	2, 992	2, 626	3, 138	3, 538	3, 362	3, 419	3, 661	3, 974	3, 362	3, 404	3, 192	3, 068	39, 736	46, 355
Refined products	6, 623	5, 647	7, 109	8, 706	9, 210	8, 935	10, 218	8, 936	7, 782	7, 453	6, 632	7, 687	94, 938	118, 122
Domestic demand:														
Motor fuel	61, 309	56, 489	68, 181	72, 219	77, 189	78, 048	81, 476	80, 348	76, 148	75, 181	72, 536	72, 146	871, 270	795, 015
Kerosine	16, 198	12, 608	10, 881	7, 807	6, 508	6, 351	6, 561	6, 193	6, 375	9, 411	10, 928	12, 399	112, 220	102, 519
Distillate fuel oil	42, 250	38, 747	33, 779	25, 505	22, 910	20, 896	18, 323	20, 210	20, 443	25, 612	30, 645	41, 256	340, 576	298, 273
Residual fuel oil	48, 679	45, 463	47, 752	42, 791	39, 717	38, 987	38, 255	38, 425	35, 026	38, 807	39, 108	47, 533	500, 543	518, 510
Lubricants	3, 021	2, 993	3, 192	3, 057	2, 923	2, 972	2, 773	2, 928	2, 818	3, 150	3, 210	2, 946	35, 983	36, 481
Miscellaneous	19, 113	17, 689	19, 742	19, 646	22, 348	21, 894	23, 941	24, 834	23, 474	21, 705	19, 469	19, 231	253, 086	239, 005
Total domestic demand	190, 570	173, 989	183, 527	171, 025	171, 595	169, 148	171, 329	172, 938	164, 284	173, 866	175, 896	195, 511	2, 113, 678	1, 989, 803
Stocks:														
Crude petroleum	229, 842	231, 419	234, 164	234, 506	231, 318	231, 412	230, 955	231, 954	237, 302	243, 972	250, 243	256, 627	256, 627	230, 654
Natural gasoline, etc	4, 323	4, 673	4, 806	5, 305	5, 622	6, 077	6, 176	6, 308	6, 287	6, 173	5, 857	5, 579	5, 579	4, 296
Refined products	256, 606	254, 104	252, 501	259, 728	276, 321	286, 130	300, 528	314, 332	324, 295	337, 375	346, 973	345, 650	345, 650	265, 850
Total stocks	490, 771	490, 196	491, 471	499, 539	513, 261	523, 619	537, 659	552, 594	567, 884	587, 520	603, 073	607, 856	607, 856	500, 800

See footnotes at end of table.

TABLE 3.—Supply and demand of all oils in the United States in 1948–49, by months—Continued

[Thousands of barrels]

	1949[3]													1948 (total)
	January	February	March	April	May	June	July	August	September	October	November	December	Total	
New supply:														
Domestic production:														
Crude petroleum	167, 072	150, 519	161, 955	150, 354	154, 146	147, 098	145, 818	148, 192	148, 206	154, 908	156, 285	155, 754	1, 840, 307	2, 020, 185
Natural gasoline	12, 987	12, 070	12, 772	12, 335	12, 465	11, 953	12, 468	13, 043	13, 259	13, 935	14, 235	14, 681	156, 203	146, 721
Benzol	11	11	11	11	11	11	11	11	11	30	30	30	189	358
Total production	180, 070	162, 600	174, 738	162, 700	166, 622	159, 062	158, 297	161, 246	161, 476	168, 873	170, 550	170, 465	1, 996, 699	2, 167, 264
Imports:														
Crude petroleum [1]	14, 131	12, 485	11, 085	11, 952	12, 669	12, 000	13, 258	12, 795	11, 228	15, 242	13, 036	15, 041	154, 922	129, 093
Refined products [2]	5, 355	4, 354	5, 107	5, 832	5, 074	5, 927	6, 078	6, 249	7, 460	9, 080	8, 051	10, 642	79, 209	59, 051
Total new supply	199, 556	179, 439	190, 930	180, 484	184, 365	176, 989	177, 633	180, 290	180, 164	193, 195	191, 637	196, 148	2, 230, 830	2, 355, 408
Change in stocks	+2, 805	+5, 741	+555	+5, 835	+10, 383	+3, 649	−222	−10, 749	−4, 940	+7, 845	−4, 449	−19, 305	−2, 852	+107, 056
Demand:														
Total demand	196, 751	173, 698	190, 375	174, 649	173, 982	173, 340	177, 855	191, 039	185, 104	185, 350	196, 086	215, 453	2, 233, 682	2, 248, 352
Exports: [2]														
Crude petroleum	2, 127	1, 942	1, 866	3, 655	2, 872	3, 071	2, 866	3, 403	2, 619	2, 916	3, 010	2, 722	33, 069	39, 736
Refined products	8, 542	7, 866	9, 074	7, 937	8, 681	6, 963	5, 939	7, 814	5, 773	6, 638	5, 585	5, 589	86, 401	94, 938
Domestic demand:														
Motor fuel	63, 083	57, 934	73, 118	75, 279	81, 622	83, 338	82, 118	84, 632	80, 760	79, 253	76, 270	75, 553	912, 960	871, 270
Kerosine	12, 963	10, 593	9, 913	6, 605	4, 577	4, 531	5, 676	6, 315	6, 799	8, 269	11, 454	14, 978	102, 673	112, 220
Distillate fuel oil	41, 569	34, 899	32, 490	22, 149	17, 575	16, 504	18, 790	22, 858	22, 478	23, 141	30, 772	44, 759	327, 984	340, 576
Residual fuel oil	48, 097	42, 911	44, 344	38, 085	35, 378	34, 877	35, 682	38, 281	39, 639	41, 130	45, 535	51, 362	495, 321	500, 543
Lubricants	2, 597	2, 195	2, 426	2, 623	2, 752	3, 023	2, 699	3, 111	3, 026	2, 927	2, 982	2, 647	33, 008	35, 983
Miscellaneous	17, 773	15, 358	17, 144	18, 316	20, 525	21, 033	24, 085	24, 625	24, 010	21, 076	20, 478	17, 843	242, 266	253, 086
Total domestic demand	186, 082	163, 890	179, 435	163, 057	162, 429	163, 306	169, 050	179, 822	176, 712	175, 796	187, 491	207, 142	2, 114, 212	2, 113, 678
Stocks:														
Crude petroleum	258, 648	265, 216	269, 341	272, 520	273, 912	274, 691	267, 586	260, 585	251, 689	250, 809	256, 010	253, 356	253, 356	256, 627
Natural gasoline	6, 217	7, 028	7, 405	7, 253	7, 418	7, 031	7, 668	7, 391	7, 607	6, 923	7, 141	6, 831	6, 831	5, 579
Refined products	343, 683	342, 045	338, 098	340, 906	349, 732	352, 989	359, 235	355, 764	359, 504	368, 913	359, 045	342, 704	342, 704	[4] 345, 650
Total stocks	608, 548	614, 289	614, 844	620, 679	631, 062	634, 711	634, 489	623, 740	618, 800	626, 645	622, 196	602, 891	602, 891	[4] 607, 856

[1] Bureau of Mines.
[2] U. S. Department of Commerce.
[3] Preliminary figures.
[4] Figures for 1948 on new basis, excluding distributors' stocks in California, and comparable with 1949 are as follows in thousands of barrels: Refined products, 343,537; total stocks, 605,743.

The total demand for distillate fuel oil amounted to 340.2 million barrels in 1949, including exports of 12.2 million and a domestic demand of 328.0 million barrels. On a daily average basis, compared with 1948, total demand declined 5.8 percent, exports fell 43.1 percent, and domestic demand was reduced 3.4 percent. Exports declined rapidly in both 1948 and 1949. Domestic demand was reduced materially in 1949 because of the decrease in heating-oil consumption due to abnormally mild weather. The expansion in the use of natural gas also reduced the rate of growth in distillate fuel-oil use.

The total demand for kerosine in 1949 amounted to 105.2 million barrels, including exports of 2.5 million and a domestic demand of 102.7 million barrels. The relative change from 1948, in daily averages, was a decline of about 9 percent in total demand, a loss of about 22 percent in exports, and a reduction of 8 percent in domestic demand. The sharp decline in the domestic demand for kerosine in 1949 was related to the effect of mild weather in reducing the use of heating oils and probably to a shift from kerosine to No. 1 distillate fuel oil in small space-heating installations.

The reduction of 13.9 million barrels in the total demand for all other products in 1949, compared with 1948, included a reduction of about 3.4 million barrels in the demand for lubricants and a decline of 14.8 million barrels in crude losses and refinery shortage. The total demand for petroleum coke increased 2.7 million barrels and the production of still gas rose 1.5 million barrels.

A brief review of supply and demand by quarters in 1949 will further clarify the trends during the year.

In the first quarter of 1949, both crude production at 5,328,000 barrels daily and total crude runs at 5,496,000 barrels daily were at the highest level during the year. Compared with the first quarter of 1948, total daily average imports were about 23 percent greater, including a gain of 50 percent for crude oil and a decline of about 8 percent for products. Total daily average demand, however, was 1.6 percent less than in 1948, including a gain of 13 percent in exports and a decline of 2.3 percent in domestic demand. The principal changes in daily average domestic demand were a gain of 5.5 percent for motor fuel and declines of 3.5 percent for residual, 4.0 percent for distillate, 14.7 percent for kerosine, and 11.6 percent for all other products. The abnormally mild weather in the first quarter of 1949, compared with the cold weather in the same period of 1948, was a major factor in the relative decline in the demand for fuel oils. Stocks of crude oil increased 12.7 million barrels during the quarter while stocks of refined products decreased only 5.4 million. Distributors and consumers evidently had unusually large stocks on hand, and seasonal restocking was postponed until later than normal.

In the second quarter of 1949, crude production dropped to only 4,963,000 barrels daily, and total crude run declined to 5,166,000 barrels daily, the lowest quarterly average during the year. Compared with the second quarter of 1948, total imports were 23 percent greater and total demand was 4.9 percent less, including a decline of 10.5 percent in exports and a drop of 4.5 percent in domestic demand. The principal changes in domestic demand were a gain of 5.6 percent for motor fuel and declines of 10.8 percent for residual fuel oil, 18.8

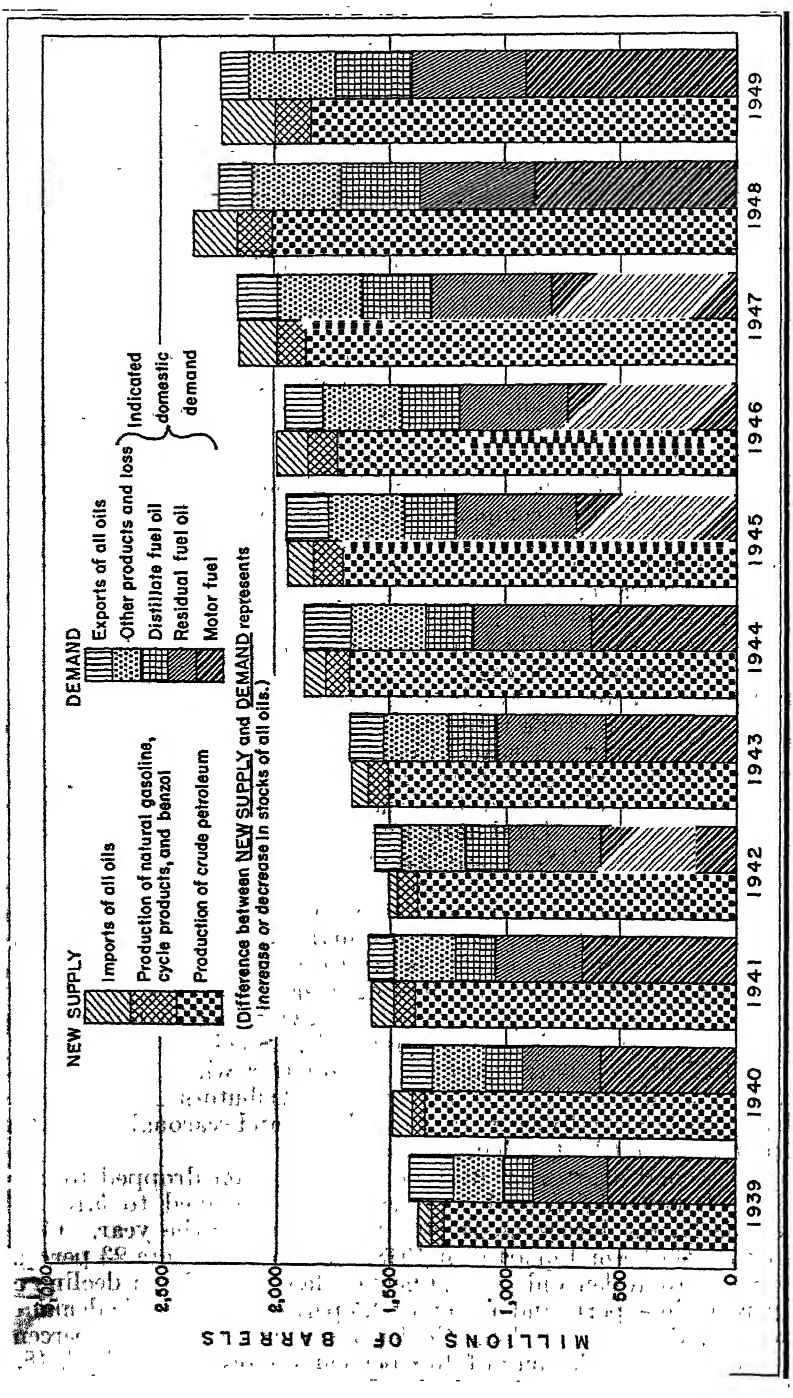

FIGURE 1.—Supply and demand of all oils in the United States, 1939–49.

percent for distillate fuel oil, 23.8 percent for kerosine, and 6.2 percent for all other products. Fuel-oil demand was reduced by a sharp drop in general industrial operations and by postponed restocking as distributors and consumers used up excess stocks left over from the first quarter. Stocks of crude oil increased 5.4 million barrels during the quarter, and stocks of refined products showed a seasonal gain of 14.9 million barrels.

In the third quarter of 1949, crude production declined further to 4,807,000 barrels daily, while total crude runs rose to 5,279,000 barrels daily. There was an upward trend in total imports, showing a gain of 21 percent compared with the third quarter of 1948. Total demand was 1.4 percent greater in the third quarter, compared with 1948, including a decline of about 26 percent in exports and a gain of 3.3 percent in domestic demand. The principal changes in domestic demand in the third quarter, compared with the same period of 1948, were gains of 4.0 percent for motor fuel, 1.7 percent for residual, and 8.7 percent for distillate, a decline of 1.9 percent for kerosine, and a gain of 1.0 percent for all other products. Stocks of crude oil were reduced 23.0 million barrels during the quarter, and stocks of refined products increased only 6.5 million barrels. While there was an upward trend in demand, stocks of refined products were still abnormally high.

In the fourth quarter of 1949, production of crude oil rose to 5,076,000 barrels daily and total crude runs increased to 5,381,000 barrels daily. Compared with the fourth quarter of 1948, total imports showed a gain of almost 32 percent, including an increase of about 99 percent in refined products. The total demand for all oils increased 3.5 percent, including a decline of about 19 percent in exports and a gain of 4.6 percent in domestic demand. The principal changes in domestic demand, compared with 1948, were gains of 5.1 percent for motor fuel, 10.1 percent for residual fuel oil, 1.1 percent for distillate fuel oil, and 5.9 percent for kerosine and a drop of 2.5 percent for other products. Total stocks of crude oil increased 1.7 million barrels during the fourth quarter and stocks of refined products declined 16.8 million. Abnormally mild weather materially reduced the normal demand for heating oils, but the demand for industrial fuel oil was strong and further increased by uncertainty as to adequate supplies of coal.

In the first quarter of 1950, crude production declined to 4,921,000 barrels daily and total crude runs to 5,380,000 barrels daily. Compared with the first quarter of 1949, total imports were about 38 percent greater, and total demand for all oils increased 8.8 percent, including a decline of almost 25 percent in exports and a gain of 10.8 percent in domestic demand. The principal changes in domestic demand compared with 1949 were gains of 7.7 percent for motor fuel, 11.3 percent for residual fuel oil, 15.2 percent for distillate fuel oil, 14.5 percent for kerosine, and 9.9 percent for other products. Stocks of crude oil were reduced 12.1 million barrels during the first quarter of 1950, and stocks of refined products declined 40.8 million barrels. The improvement in demand was primarily the result of normal weather and a shortage of coal that stimulated conversions to fuel oil.

This review covers a critical period of oil operations and demand. The abnormal accumulations of refined stocks in 1948 overhung the market and depressed refinery operations until the end of the first quarter of 1950, when such stocks were reduced to close to minimum seasonal levels. Mild weather in the first and last quarters of 1949 depressed the demand for heating oils far below normal. The rapid expansion in the volume of natural gas marketed has taken a substantial part of the increased fuel market that might have gone to oil or coal. The curtailment of coal supply during the past winter was a material stimulus to the substitution of oil fuel where conversion facilities were available, but much of this increased demand was met by a 100-percent gain in the imports of residual fuel oil in the winter of 1949–50 compared with the winter of 1948–49.

Demand in Noncontiguous Territories.—In computing domestic demand in continental United States, the shipments from the United States to the Territories are included with exports, and any imports from foreign countries to the Territories are deleted from total imports. The major part of such shipments from the United States go to Hawaii, Alaska, and Puerto Rico. Puerto Rico is normally the chief Territorial importer of foreign oils.

The accompanying table has been prepared to show shipments to the Territories from the United States and imports received by them. No crude oil is involved in their movements. The receipts of products from the United States plus the imports from foreign sources indicate the total supply available in the Territories and, less some minor reexports, indicate their total demand.

The figures for 1949 indicate that shipments to the Territories from the United States rose from 12,179,000 barrels in 1948 to 13,353,000 barrels in 1949 and that total direct imports from foreign countries increased from 2,567,000 barrels in 1948 to 2,881,000 barrels in 1949. The indicated total supply of all oils in the Territories rose from

TABLE 4.—Imports and exports of crude petroleum and petroleum products

[Thousands of barrels]

Product [1]	Imports					
	1948			1949		
	Continental United States	Noncontiguous Territories	Total	Continental United States	Noncontiguous Territories	Total
Gasoline	302	125	427		15	15
Kerosine	135	12	147			
Distillate fuel oil	2,546	5	2,551	1,720	541	2,261
Residual fuel oil	53,269	2,400	55,669	74,555	2,238	76,793
Lubricants	101		101			
Wax	27		27			
Coke						
Asphalt	1,557	25	1,582	1,184	86	1,270
Other unfinished oils	1,114		1,114	1,750	1	1,751
Total	59,051	2,567	61,618	79,209	2,881	82,090
Crude petroleum [2]	129,093		129,093	154,922		154,922

See footnotes at end of table.

TABLE 4.—Imports and exports of crude petroleum and petroleum products Continued

[Thousands of barrels]

Product [1]	Exports					
	1948			1949		
	Foreign	Noncontiguous Territories	Total	Foreign	Noncontiguous Territories	Total
Motor fuel	32,600	4,702	37,302	33,882	5,592	39,474
Kerosine	2,888	607	3,495	1,819	713	2,532
Distillate fuel oil	18,281	3,012	21,293	9,753	2,436	12,189
Residual fuel oil	9,471	3,540	13,011	8,549	4,092	12,641
Lubricants: Grease	391	5	396	390	3	393
Oil	12,852	144	12,996	12,427	185	12,612
Wax	994		994	1,030		1,030
Coke	2,506	15	2,521	2,441	39	2,480
Asphalt	1,483	145	1,628	1,274	278	1,552
Miscellaneous	1,293	9	1,302	1,483	15	1,498
Total	82,759	12,179	94,938	73,048	13,353	86,401
Crude petroleum [1]	39,736		39,736	33,069		33,069

[1] U. S. Department of Commerce: 1948 final data; 1949 preliminary data.
[2] Bureau of Mines data.

14,746,000 barrels in 1948 to 16,234,000 barrels in 1949. Reexports to foreign countries amounted to 234,000 barrels in 1948 and 258,000 barrels in 1949. (See table of exports by countries of destination, in the last section of this chapter.) These figures indicate a total net demand for oil products in the noncontiguous Territories of about 14.5 million barrels in 1948 and 16.0 million barrels in 1949. If these figures are added to the domestic demand figures for continental United States, the sum will show the total domestic demand within the political boundaries of the United States.

World Oil Supply.—World production of crude petroleum in 1949 declined from 3,433 million barrels in 1948 to 3,398 million in 1949. The total decline of 35 million barrels represents a decrease of 180 million barrels for the United States and a gain of 145 million for the rest of the world. The largest gains in production were 44 million barrels for Kuwait, 31 millions for Saudi Arabia, 15 million estimated for Russia, 14 million for Iran, 13 million for Indonesia, 10 million for Canada, and 6 million for Colombia. The chief decreases in production outside the United States were about 8 million barrels for Venezuela and less than 1 million for Argentina. The United States produced 54.2 percent of the world total in 1949 compared with 58.8 percent in 1948 and 61.4 percent in 1947.

According to data for 1949 in this report, exports and shipments of all oils from continental United States totaled 119.5 million barrels and imports 234.1 million, resulting in a net import of 114.6 million barrels in 1949 compared with a net import of 53.5 million in 1948. As total stocks of all oils declined 2.9 million barrels in 1949, the production of all oils in the United States of 1,996.7 million barrels was 117.5 million less than domestic demand in continental United States, amounting to 2,114.2 million barrels.

RESERVES

The Committee on Petroleum Reserves, American Petroleum Institute, estimated proved reserves of crude oil in the United States on December 31, 1949, at 24,649 million barrels, compared with 23,280 million on December 31, 1948. These estimates refer solely to proved or blocked-out reserves, including only oil recoverable under existing economic and operating conditions.

The increase in total net crude reserves in 1949 was 1,369 million barrels. In arriving at this net figure, the total of estimated new reserves added in 1949 was 3,188 million barrels, including an upward revision of 2,298 million of reserves due to extensions of old pools and revisions of previous estimates and an estimate of 890 million for new reserves discovered in 1949 in new fields and in new pools in old fields. From this estimate of total reserves added in 1949 was deducted an estimated production of 1,819 million barrels of crude oil during 1949 to determine the net gain in total reserves.

TABLE 5.—Estimates of proved oil reserves in the United States, on Dec. 31, 1943–49, by States [1]

[Millions of barrels]

State	1943	1944	1945	1945 [2]	1946	1947	1948	1949
Eastern States:								
Illinois	295	321	350	350	351	355	393	468
Indiana	31	31	41	41	44	46	49	50
Kentucky	35	41	57	57	59	65	59	56
Michigan	55	65	64	64	69	70	69	66
New York	90	86	81	81	76	71	67	63
Ohio	33	32	30	30	29	29	29	28
Pennsylvania	137	123	110	110	98	123	110	103
West Virginia	44	41	39	39	36	36	37	38
Total	720	740	772	772	762	795	813	872
Central and Southern States:								
Arkansas	297	293	304	288	267	297	300	297
Kansas	646	602	542	542	545	563	674	738
Louisiana	1,484	1,573	1,690	1,559	1,652	1,791	1,869	1,910
Mississippi	39	209	267	257	270	304	365	403
New Mexico	654	563	512	512	544	530	552	592
Oklahoma	909	970	890	889	898	953	1,250	1,330
Texas	11,325	11,375	11,470	10,835	11,647	11,777	12,484	13,510
Total	15,354	15,585	15,675	14,882	15,823	16,215	17,494	18,780
Mountain States:								
Colorado	45	89	260	260	300	382	366	345
Montana	108	112	108	108	104	115	119	112
Wyoming	499	582	600	600	589	679	716	692
Total	652	783	968	968	993	1,176	1,201	1,149
Pacific Coast States: California	3,337	3,344	3,410	3,318	3,294	3,295	3,764	3,823
Other States	1	1	2	2	2	7	8	25
Total United States	20,064	20,453	20,827	19,942	20,874	21,488	23,280	24,649

[1] From reports of Committee on Petroleum Reserves, American Petroleum Institute, of the amount of crude oil that may be extracted by present methods from fields completely developed or sufficiently explored to permit reasonably accurate calculations. The change in reserves during any year represents total new discoveries, extensions, and revisions, minus production.
[2] New basis; excludes condensate.

The principal changes in net crude-oil reserves in 1949 were gains of 1,026 million barrels for Texas, 80 million for Oklahoma, 75 million for Illinois, 64 million for Kansas, 59 million for California, 41 million for Louisiana, 40 million for New Mexico, and 38 million for Mississippi. The principal declines were 24 million for Wyoming and 21 million for Colorado.

As of December 31, 1949, Texas had 54.8 percent of the total estimated reserves, California 15.5 percent, Louisiana 7.7 percent, and Oklahoma 5.4 percent—83.4 percent of the total for the four States combined.

The total proved reserves of natural-gas liquids, not included in the crude-oil reserves, were 3,729 million barrels on December 31, 1949. This figure, combined with the crude-oil reserves, made a proved reserve for all liquid hydrocarbons of 28,378 million barrels on December 31, 1949, compared with 26,821 million barrels as of December 31, 1948.

CRUDE PETROLEUM

SUPPLY AND DEMAND

The total demand for crude petroleum in 1949 amounted to 1,998.5 million barrels or an average of 5,475,000 barrels daily, a decline of 326,000 barrels daily or 5.6 percent compared with 1948. The demand for domestic crude oil declined from 5,460,000 barrels daily in 1948 to 5,048,000 barrels daily, a decrease of 412,000 barrels daily or 7.5 percent. The demand for foreign crude oil rose from 341,000 barrels daily in 1948 to 427,000 barrels daily in 1949, an increase of 86,000 barrels daily or 25.5 percent.

The new supply of crude petroleum in 1949 included a domestic production of 1,840.3 million barrels of 5,042,000 barrels daily and an import of 154.9 million barrels or 425,000 barrels daily. Total stocks of crude petroleum increased 71,000 barrels daily in 1948 but declined 9,000 barrels daily in 1949. Stocks of refined products increased 218,000 barrels daily in 1948 but declined 2,000 barrels daily in 1949. The total demand for all oils averaged 6,143,000 barrels daily in 1948 and 6,119,000 barrels daily in 1949, a decline of 24,000 barrels daily or 0.4 percent. (Daily averages are used in computing changes, since 1948 was a leap year with 366 days.)

The preceding figures indicate that crude demand was inflated in 1948 by large additions to stocks of crude oil and refined products. With a small decline in the total demand for all oils in 1949 and small withdrawals from stocks, compared with large gains in 1948, the total supply of crude oil required declined sharply, and the decline in domestic crude oil was even greater due to the large gain in crude imports.

Most of the excessive stocks of refined products at the end of 1948 were still on hand at the end of 1949 and were only reduced to normal levels during the first quarter of 1950, when demand for all oils was unexpectedly high and refinery operations were maintained at a low seasonal level.

In comparing the various uses for crude oil in 1949 with 1948, the changed basis for reporting crude transfers and runs in California in 1949 must be considered. If 1948 is revised to compare with the new basis used in 1949, some 17.3 million barrels of domestic crude oil will be added to total crude runs, involving a reduction of transfers of crude oil to residual fuel oil of 17.1 million barrels.

On this bases, the total demand for crude oil in 1949 remains the same, showing a decline from 1948 of 124.8 million barrels. Runs to stills were reduced from 2,048.3 million barrels (new basis) in 1948 to

1,945.5 million in 1949, a decline of 102.8 million barrels, 267,000 barrels daily or 4.8 percent. Crude exports declined from 39.7 million barrels in 1948 to 33.1 million in 1949. Transfers to residual and distillate fuel oils declined from 10.2 million barrels (new basis) in 1948 to 7.5 million in 1949, and crude losses declined from 25.0 million (new basis) in 1948 to 12.5 million in 1949.

TABLE 6.—Supply and demand for crude petroleum in the United States, 1945–49

[Thousands of barrels]

	1945	1946	1947	1948	1948 [1]	1949 [2]
Production	1,713,655	1,733,939	1,856,987	2,020,185	2,020,185	1,840,307
Imports [3]	74,337	86,066	97,532	129,093	129,093	154,922
Total new supply	1,787,992	1,820,005	1,954,519	2,149,278	2,149,278	1,995,229
Change in stocks [4]	−3,511	+6,917	+478	+25,973	+25,973	−3,271
Demand:						
Domestic crude	1,717,650	1,728,102	1,856,479	1,998,357	1,998,357	1,842,540
Foreign crude	73,853	84,986	97,562	124,948	124,948	155,960
Total demand	1,791,503	1,813,088	1,954,041	2,123,305	2,123,305	1,998,500
Runs to stills:						
Domestic	1,645,862	1,645,845	1,754,987	1,907,027	1,924,335	1,790,906
Foreign	73,672	84,352	97,259	124,014	124,014	154,613
Exports [5]	32,998	42,436	46,355	39,736	39,736	33,069
Transfers to fuel oil:						
Distillate	3,047	3,123	3,263	3,543	3,543	2,701
Residual	20,727	23,142	27,091	23,847	6,699	4,750
Other fuel and losses	15,197	14,190	25,086	25,138	24,978	12,461
Total demand	1,791,503	1,813,088	1,954,041	2,123,305	2,123,305	1,998,500

[1] Includes California data on a new basis to compare with 1949.
[2] Preliminary figures.
[3] Bureau of Mines data.
[4] Inclusive of heavy crude in California, 1945–48; separation discontinued in 1949.
[5] Bureau of Mines, 1945–46; U. S. Department of Commerce, 1947–49.

PRODUCTION

General

Production of crude petroleum in the United States dropped from the record level of 2,020.2 million barrels in 1948 to 1,840.3 million in 1949, a decline of 478,000 barrels daily or 8.7 percent.

The decrease of 179.9 million barrels in crude production in 1949 compared with 1948 was distributed very irregularly among States. Only a few States showed gains, including Louisiana with an increase of 9.2 million barrels, Colorado with 6.1 million, Indiana with 2.6 million, and smaller gains for Utah and West Virginia. The principal declines in production in 1949 were 159.5 million barrels for Texas, 9 million for Kansas, 8.1 million for Wyoming, 7.8 million for Mississippi, 7.2 million for California, 1.7 million for Ohio, 1.7 million for Arkansas, and 1.3 million for Pennsylvania. In a few instances the declines may have been due to natural conditions affecting production, but generally they were due to a static market for all oils, lower refining operations resulting from excess product stocks, the sharp decline in the demand for heavy crudes used in fuel-oil production, and the low demand for lubricating oils.

Thirteen States produced over 10 million barrels of crude oil in 1949, representing 97.9 percent of total production in 1949 compared with 98.2 percent in 1948. Six States produced more than 50 mil-

lion barrels of oil in 1949, and these States combined produced 86.2 percent of the total in 1949 compared with 86.9 percent in 1948. Texas ranked first with 40.4 percent of the total national output in 1949, California second with 18.1 percent, Louisiana third with 10.4 percent, Oklahoma fourth with 8.3 percent, Kansas fifth with 5.5 percent, and Illinois sixth with 3.5 percent. Texas was the only State in the group to show a decline in the percentage of total output in 1949 compared with 1948.

The seven States next in importance produced 11.7 percent of the national output in 1949 compared with 11.3 percent in 1948. New Mexico, with static production, ranked as the seventh State in importance, while Wyoming dropped to eighth place owing to a sharp decline in production. Mississippi and Arkansas retained ninth and tenth places, even though production declined compared with 1948. Colorado was the only State in this group to show a gain in production and remained the eleventh producer, followed by Michigan and Pennsylvania.

The production of all other States rose from 1.8 percent of the national total in 1948 to 2.1 percent in 1949. The gain in production in Indiana from 7 million barrels in 1948 to 9.6 million in 1949 was the most notable increase while production in most other States declined.

TABLE 7.—Petroleum produced in the United States, 1945–49, and total, 1859–1949, by States [1]

[Thousands of barrels]

	1945	1946	1947	1948	1949 [2]	1859–1949 (total)
Production:						
Alabama	181	380	396	466	462	1,928
Arkansas	28,613	28,375	29,948	31,682	29,936	764,944
California	326,482	314,713	333,132	340,074	332,839	8,291,888
Colorado	5,036	11,856	15,702	17,862	23,934	124,038
Florida	30	57	259	290	441	1,093
Illinois	75,094	75,297	66,459	64,808	64,583	1,444,370
Indiana	4,868	6,726	6,095	6,974	9,556	189,884
Kansas	96,415	97,218	105,132	110,908	101,868	[3] 2,018,292
Kentucky	10,325	10,578	9,397	8,801	8,656	[4] 241,718
Louisiana	131,051	143,669	160,128	181,458	190,715	2,351,940
Michigan	17,267	17,074	16,215	16,871	16,495	[5] 306,399
Mississippi	19,062	24,298	34,925	45,761	37,966	245,823
Montana	8,420	8,825	8,742	9,382	9,149	160,173
Nebraska	305	293	229	215	330	5,837
New Mexico	37,351	36,814	40,926	47,969	47,932	[6] 635,315
New York	4,648	4,863	4,762	4,621	4,248	[7] 162,281
Ohio	2,828	2,908	3,108	3,600	3,433	617,566
Oklahoma	139,299	134,794	141,019	154,455	151,902	6,070,752
Pennsylvania	12,515	12,996	12,690	12,667	11,374	1,123,714
Texas	754,710	760,215	820,210	903,498	743,990	12,892,141
West Virginia	2,879	2,929	2,617	2,692	2,839	438,152
Wyoming	36,219	38,977	44,772	55,032	46,935	853,212
Other States [8]	57	84	124	99	724	2,421
Total	1,713,655	1,733,939	1,856,987	2,020,185	1,840,307	38,943,881
Value at wells:						
Total (thousands of dollars)	2,094,250	2,442,550	3,577,890	5,245,080	4,667,480	53,320,188
Average per barrel	$1.22	$1.41	$1.93	$2.60	$2.54	$1.37

1 For detailed figures by States, 1859–1935, see Minerals Yearbook, 1937, p. 1008.
2 Preliminary figures.
3 Oklahoma included with Kansas in 1905 and 1906.
4 Includes Tennessee, 1883–1907.
5 Figures represent 1925–49 production only; earlier years included under "Other States."
6 Figures represent 1924–49 production only; earlier years included under "Other States."
7 Early production in New York included with Pennsylvania.
8 Includes Alaska, 1912–33; Arkansas, 1920; Michigan, 1900–19; Missouri, 1899–1911, 1913–16, 1919–23, 1932–49; New Mexico, 1913, 1919–23; Tennessee, 1916–49; Utah, 1907–11, 1920, 1924–41, 1948–49; Virginia, 1943–49.

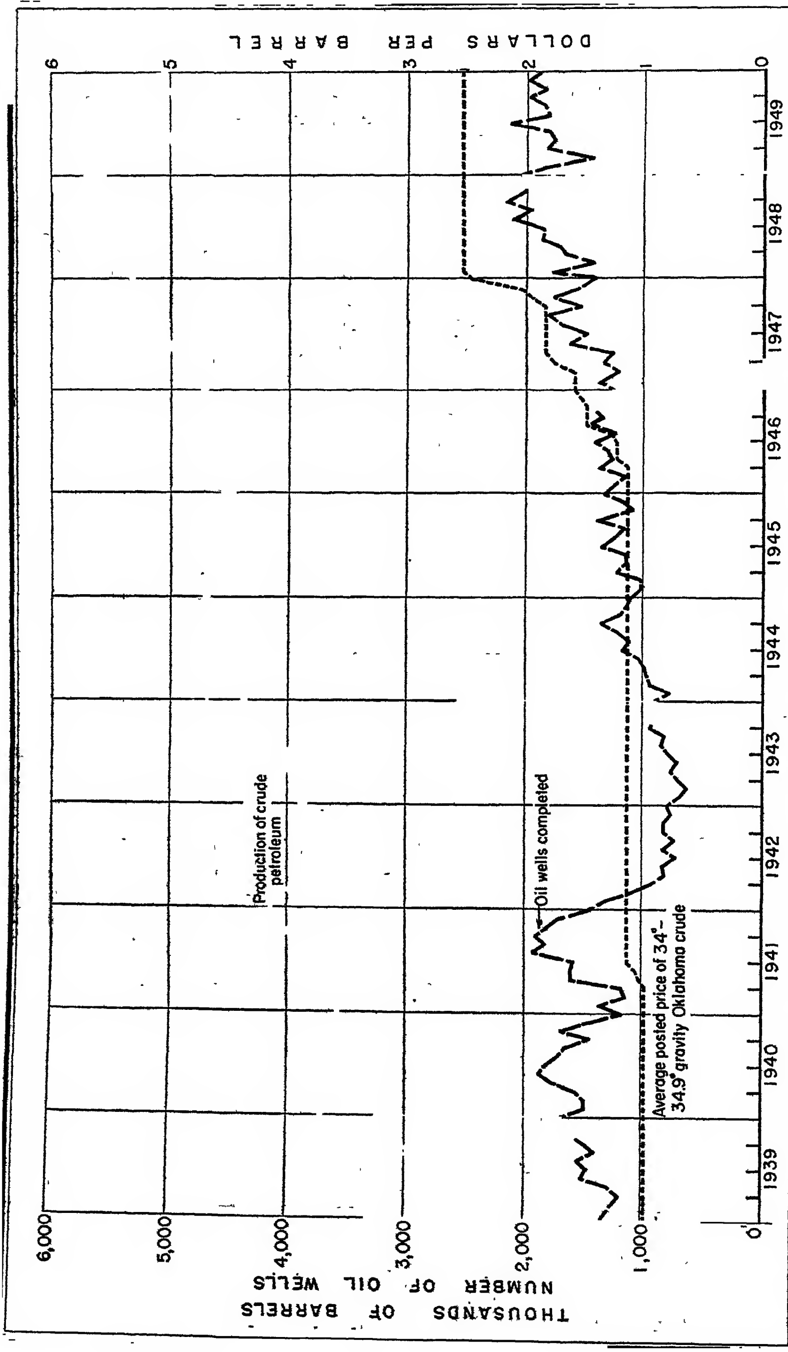

FIGURE 2.—Daily average production of crude petroleum, total number of oil wells completed, and average posted price per barrel of a selected grade of Oklahoma crude petroleum in the United States, 1939–49, by months.

TABLE 8.—Production of crude petroleum in the United States in 1948,[1] by districts, States, and months

[Thousands of barrels]

District and State	January	February	March	April	May	June	July	August	September	October	November	December	Total
DISTRICT													
Pennsylvania Grade	1,773	1,677	1,969	1,902	1,869	1,922	1,914	1,905	1,855	1,830	1,857	1,818	22,291
Other Appalachian [2]	859	814	925	789	872	851	869	858	859	890	851	894	10,331
Lima-northeastern Indiana-Michigan	1,411	1,314	1,407	1,365	1,360	1,384	1,417	1,470	1,447	1,450	1,453	1,518	16,996
Illinois-southwestern Indiana	5,837	5,542	5,961	5,631	5,922	5,884	6,077	6,183	6,013	6,277	6,096	6,335	71,758
Mid-Continent:													
North Louisiana, Arkansas, Alabama, Mississippi	9,570	9,357	10,018	9,816	10,175	9,946	10,411	10,456	10,090	10,625	10,355	10,558	121,377
West Texas, southeastern New Mexico	25,406	24,090	26,128	25,930	27,066	26,284	27,151	27,653	27,032	28,803	27,881	29,030	322,454
East Texas	9,091	9,175	9,914	9,507	9,496	9,427	9,404	9,434	9,400	9,320	9,036	9,080	112,284
Oklahoma, Kansas, north Texas, etc.	40,707	38,537	41,330	41,499	43,032	41,924	42,841	43,343	42,357	43,943	42,757	45,253	507,523
Gulf Coast	33,917	31,982	34,423	33,432	34,657	33,665	34,793	35,077	34,128	35,506	34,823	36,027	412,430
Rocky Mountain	6,666	6,034	6,669	6,571	6,920	6,702	7,139	7,199	7,048	7,232	7,057	7,430	82,667
California [3]	28,861	27,055	29,124	28,284	29,336	28,459	29,353	29,437	23,015	29,096	28,611	29,443	340,074
Total	164,098	155,577	167,868	164,726	170,705	166,448	171,369	173,015	163,244	174,972	170,777	177,386	2,020,185
STATE													
Alabama	39	38	36	34	43	41	39	41	39	41	37	38	466
Arkansas	2,583	2,545	2,689	2,575	2,632	2,568	2,691	2,691	2,624	2,751	2,646	2,687	31,682
California [3]	28,861	27,055	29,124	28,284	29,336	28,459	29,353	29,437	23,015	29,096	28,611	29,443	340,074
Colorado	1,435	1,275	1,386	1,356	1,446	1,414	1,461	1,445	1,420	1,500	1,676	2,048	17,862
Florida	24	23	26	23	22	24	25	24	23	27	21	28	290
Illinois	5,335	5,068	5,435	5,113	5,377	5,336	5,509	5,608	5,380	5,600	5,435	5,612	64,808
Indiana	504	476	528	520	547	550	570	577	635	679	663	725	6,974
Kansas	8,966	8,311	8,490	9,214	9,686	9,400	9,482	9,621	9,323	9,593	9,075	9,747	110,908
Kentucky	748	706	801	663	736	732	738	728	726	746	730	747	8,801
Louisiana	14,560	13,821	14,883	14,598	15,246	14,809	15,403	15,616	15,064	15,761	15,554	16,143	181,458
Michigan	1,401	1,308	1,397	1,354	1,350	1,370	1,406	1,458	1,437	1,441	1,443	1,506	16,871
Mississippi	3,526	3,419	3,702	3,652	3,817	3,760	4,027	4,021	3,856	4,069	3,956	3,956	45,761
Montana	750	678	760	748	773	805	827	833	799	822	788	799	9,382
Nebraska	17	14	18	17	18	20	21	20	16	18	17	19	215
New Mexico	3,840	3,712	4,026	3,921	3,992	3,832	4,054	4,109	3,977	4,200	4,074	4,232	47,969
New York	375	351	410	387	386	397	396	390	389	368	386	386	4,621
Ohio	259	251	309	302	303	312	317	324	309	305	298	311	3,600
Oklahoma	12,163	11,673	12,670	12,612	12,982	12,752	13,018	13,163	12,896	13,407	13,142	13,977	154,455
Pennsylvania	1,021	961	1,115	1,089	1,071	1,093	1,083	1,073	1,048	1,047	1,046	1,020	12,667
Texas	73,027	69,637	75,328	73,591	76,039	74,090	75,895	76,710	75,239	78,386	76,377	79,179	903,498
Utah										5	5	6	16
West Virginia	210	199	234	230	222	224	230	231	225	230	232	225	2,692
Wyoming	4,448	4,050	4,491	4,435	4,669	4,455	4,818	4,889	4,800	4,873	4,560	4,544	55,032
Other States	6	6	10	8	12	5	6	6	4	7	5	8	[4] 83
Total: 1948	164,098	155,577	167,868	164,726	170,705	166,448	171,369	173,015	163,244	174,972	170,777	177,386	2,020,185
1947	144,823	134,696	152,178	149,410	156,055	153,058	159,366	160,448	157,665	165,032	158,701	165,555	1,856,987
Daily average, 1948	5,293	5,365	5,415	5,491	5,507	5,548	5,528	5,581	5,441	5,644	5,693	5,722	5,520

[1] Final figures.
[2] Includes Florida, Kentucky, Tennessee, and Virginia.
[3] American Petroleum Institute.
[4] Missouri (31), Tennessee (19), and Virginia (33).

TABLE 9.—Production of crude petroleum in the United States in 1949,[1] by districts, States, and months

[Thousands of barrels]

District and State	January	February	March	April	May	June	July	August	September	October	November	December	Total
DISTRICT													
Pennsylvania Grade	1,724	1,634	1,827	1,716	1,710	1,743	1,667	1,790	1,685	1,713	1,628	1,668	20,505
Other Appalachian [2]	829	751	873	838	866	837	859	883	892	953	937	925	10,443
Lima-northeastern Indiana-Michigan	1,471	1,278	1,418	1,350	1,300	1,333	1,345	1,424	1,433	1,419	1,377	1,479	16,627
Illinois-southwestern Indiana	5,828	5,459	6,213	5,980	6,362	6,159	6,213	6,488	6,312	6,408	6,321	6,372	74,115
Mid Continent:													
North Louisiana, Arkansas, Alabama, Mississippi	10,120	9,003	9,762	9,584	9,922	8,952	9,027	9,298	8,992	9,295	9,343	9,459	112,757
West Texas, southeastern New Mexico	26,630	23,688	24,696	21,464	21,995	21,307	20,908	21,562	22,153	23,694	24,805	24,088	276,990
East Texas	8,936	8,998	8,594	7,688	7,820	7,357	6,961	6,911	7,347	7,732	8,122	7,485	93,951
Oklahoma, Kansas, north Texas, etc.	41,882	37,742	40,996	38,355	39,269	37,297	36,374	37,356	37,373	39,607	40,034	39,773	466,058
Gulf coast	33,537	29,728	31,515	28,417	29,366	27,777	27,303	27,574	28,133	30,169	30,925	30,584	355,023
Rocky Mountain	6,959	5,730	6,619	6,691	6,793	6,715	7,046	7,125	6,944	6,733	6,644	7,000	80,999
California [3]	29,156	26,513	29,442	28,271	28,743	27,621	28,115	27,781	26,942	27,185	26,149	26,921	332,839
Total	167,072	150,519	161,955	150,354	154,146	147,098	145,818	148,192	148,206	154,908	156,285	155,754	1,840,307
STATE													
Alabama	38	35	39	34	35	36	36	37	42	38	43	49	462
Arkansas	2,631	2,439	2,651	2,568	2,651	2,351	2,273	2,401	2,339	2,442	2,550	2,640	29,936
California [3]	29,156	26,513	29,442	28,271	28,743	27,621	28,115	27,781	26,942	27,185	26,149	26,921	332,839
Colorado	2,038	1,798	1,955	2,025	1,980	1,935	2,161	2,105	1,991	2,044	1,956	1,946	23,934
Florida	39	33	36	44	39	41	44	45	31	29	31	29	441
Illinois	5,163	4,841	5,480	5,248	5,509	5,369	5,411	5,651	5,508	5,490	5,433	5,480	64,583
Indiana	667	620	735	734	855	792	804	839	806	920	890	894	9,556
Kansas	8,796	8,091	9,383	8,727	8,851	8,282	7,764	7,971	8,093	8,590	8,651	8,669	101,868
Kentucky	696	618	728	684	719	673	707	713	745	804	789	780	8,656
Louisiana	16,166	14,649	15,888	15,590	16,579	15,425	15,412	15,456	15,222	16,688	16,569	17,071	190,715
Michigan	1,463	1,269	1,406	1,338	1,288	1,321	1,333	1,413	1,421	1,407	1,367	1,469	16,495
Mississippi	3,580	3,028	3,383	3,286	3,376	2,990	3,073	3,124	2,990	3,069	3,017	3,050	37,966
Montana	761	656	810	815	835	807	794	760	739	742	726	704	9,149
Nebraska	21	18	20	20	17	18	28	23	25	49	41	50	330
New Mexico	4,065	3,799	4,216	3,936	4,123	4,009	3,933	3,963	3,814	4,065	3,956	4,053	47,932
New York	367	346	376	355	349	358	349	373	347	347	332	349	4,248
Ohio	258	267	304	282	283	316	276	310	288	288	283	278	3,433
Oklahoma	13,480	11,831	13,061	12,631	12,956	12,163	12,075	12,387	12,115	12,979	13,003	13,221	151,902
Pennsylvania	983	916	1,029	970	956	959	919	980	922	940	884	916	11,374
Texas	72,353	65,289	66,953	58,742	59,812	57,442	56,008	57,364	59,382	62,607	65,425	62,613	743,990
Utah	6	6	11	14	41	49	58	73	78	101	93	83	613
West Virginia	212	209	233	226	235	238	236	254	247	260	247	242	2,839
Wyoming	4,125	3,242	3,810	3,805	3,906	3,894	3,999	4,157	4,108	3,812	3,840	4,237	46,935
Other States	8	6	6	9	8	9	10	12	11	12	10	10	[4] 111
Total: 1949	167,072	150,519	161,955	150,354	154,146	147,098	145,818	148,192	148,206	154,908	156,285	155,754	1,840,307
1948	164,098	155,577	167,868	164,726	170,705	166,448	171,369	173,015	163,244	174,972	170,777	177,386	2,020,185
Daily average, 1949	5,389	5,376	5,224	5,012	4,972	4,903	4,704	4,780	4,940	4,997	5,210	5,024	5,042

[1] Preliminary figures.
[2] Includes Florida, Kentucky, Tennessee, and Virginia.
[3] American Petroleum Institute.
[4] Missouri (46), Tennessee (22), and Virginia (43).

TABLE 10.—Percentage of total crude petroleum produced in the United States, 1940–49, by principal States

State	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949 [1]
Texas	36.4	36.1	34.8	39.5	44.5	44.0	43.8	44.2	44.7	40.4
California	16.6	16.4	17.9	18.9	18.6	19.1	18.2	17.9	16.8	18.1
Louisiana	7.7	8.3	8.3	8.2	7.7	7.7	8.3	8.6	9.0	10.4
Oklahoma	11.5	11.0	10.2	8.2	7.4	8.1	7.8	7.6	7.7	8.3
Kansas	4.9	5.9	7.0	7.0	5.9	5.6	5.6	5.7	5.5	5.5
Illinois	10.9	9.4	7.7	5.5	4.6	4.4	4.3	3.6	3.2	3.5
New Mexico	2.9	2.8	2.3	2.6	2.4	2.2	2.1	2.2	2.4	2.6
Wyoming	1.9	2.1	2.4	2.3	2.0	2.1	2.2	2.4	2.7	2.6
Mississippi	.3	1.1	2.1	1.2	1.0	1.1	1.4	1.9	2.3	2.1
Arkansas	1.9	1.9	1.9	1.8	1.8	1.7	1.6	1.6	1.6	1.6
Colorado	.1	.2	.1	.2	.2	.3	.7	.8	.9	1.3
Michigan	1.5	1.2	1.6	1.4	1.1	1.0	1.0	.9	.8	.9
Pennsylvania	1.3	1.2	1.3	1.0	.8	.7	.8	.7	.6	.6
Other States	2.1	2.4	2.4	2.2	2.0	2.0	2.2	1.9	1.8	2.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Preliminary figures.

Production by States

Alabama.—Crude production in 1949 totaled 462,000 barrels compared with 466,000 barrels the previous year, a decline of 4,000 barrels. There were 14 wildcat wells drilled during the year in 8 counties in southern Alabama; however, all were failures. Four oil wells were completed in the Gilbertown field, Choctaw County, which raises the producers to 39. Daily average production per well in the field is approximately 36 barrels, and cumulative production through December 1949 totals 1,927,548 barrels. Humble Oil & Refining Co. drilled the deepest well of the year in Washington County. It was dry and abandoned at 15,668 feet after hitting salt.

Arkansas.—Crude-oil output declined 5.5 percent in 1949 compared with 1948, when production dropped from 31,682 thousand barrels to 29,936 thousand barrels. This decrease was the result of an emergency order of the Arkansas Oil and Gas Commission issued in June, which reduced the top allowables for wells in controlled fields 15 percent. This order remained in effect until November 1, when the allowable was increased.

The Magnolia field, Columbia County, continued to lead all others in production, with an annual output of 4,292 thousand barrels in 1949. The Smackover field was second with 3,900 thousand barrels, the Schuler field third with 3,170 thousand barrels, and the Wesson field fourth with 2,638 thousand barrels.

During 1949, 321 wells were drilled representing a moderate gain over the previous year. Wildcat drilling declined from 106 wells in 1948 to only 78 in 1949. Adhering to the pattern of recent years, greatest activity was centered in southern Arkansas in Union, Ouachita, Nevada, and Columbia Counties. Three new oil fields, three new pools, and two producing zones were discovered during the year.

The most promising of the new discoveries are the Pine Tree field, Columbia County, and the Curry pool, Ouachita County. In the former field the discovery well flowed over 500 barrels daily from perforations at 8,426 to 8,433 feet opposite porous section of the Smackover lime topped at 8,412 feet. Two additional producers have been

TABLE 11.—Production of crude petroleum in leading fields and districts in the United States, 1948–49, and total production since discovery, in thousands of barrels

[Oil and Gas Journal]

Field	State	1948	1949	Total since discovery [1]
East Texas	Texas	111,829	93,589	2,679,804
Wilmington	California	48,583	43,655	460,880
Panhandle	Texas	31,687	33,165	663,099
Coalinga	California	32,369	27,112	620,218
Slaughter-Levelland	Texas	26,821	22,822	163,130
Ventura Avenue	California	17,786	21,133	376,787
Huntington Beach	do	20,825	21,116	438,269
Rangely	Colorado	13,412	19,549	56,662
Wasson	Texas	28,884	19,278	197,563
T-X-L	do	24,089	16,474	63,394
Hastings	do	21,648	14,308	183,214
Buena Vista	California	16,610	13,962	377,976
Bradford-Allegany [2]	Pennsylvania-New York	14,965	13,305	586,222
Webster	Texas	20,768	13,144	138,782
Midway-Sunset	California	15,167	12,749	748,775
Yates	Texas	18,103	11,883	361,757
Kettleman-North Dome	California	12,887	11,740	361,948
Thompson	Texas	16,958	11,734	142,719
Conroe	do	20,440	11,633	281,210
Hawkins	do	17,621	11,453	107,849
Keystone	do	14,586	11,029	76,564
Velma	Oklahoma	13,225	10,134	43,128
Fullerton	Texas	16,011	10,069	60,802
Goldsmith	do	11,128	9,141	102,349
Trapp	Kansas	10,404	8,905	114,599
Seeligson	Texas	12,269	8,641	67,040
Coles Levee	California	7,809	8,510	65,130
Long Beach	do	8,268	8,356	743,040
Van	Texas	12,124	8,312	203,777
McElroy	do	10,629	8,146	193,690
Lake St. John	Louisiana	8,094	8,080	29,728
Oklahoma City	Oklahoma	8,543	7,703	668,458
Delta Farms	Louisiana	6,754	7,570	31,401
Elk Basin	Wyoming-Montana	8,168	7,105	48,815
Anahuac	Texas	10,758	7,090	94,251
Kern	California	8,271	7,014	378,550
Russell Ranch	do	842	6,885	7,727
Drinkard	New Mexico	6,236	6,742	17,100
Monument	do	6,902	6,488	100,345
Coyote	California	7,395	6,485	223,302
Talco	Texas	8,795	6,168	116,815
North Cowden	do	8,978	6,109	81,590
Louden	Illinois	6,715	6,077	149,654
Foster	Texas	6,980	6,013	57,173
La Gloria	do	6,656	5,908	27,219
Erath	Louisiana	6,252	5,886	36,634
Santa Maria Valley	California	7,407	5,693	97,212
Tinsley	Mississippi	6,054	5,560	112,594
Mallalieu	do	6,141	5,524	14,099
West Edmond	Oklahoma	9,322	5,478	87,964
Santa Fe Springs	California	5,513	5,340	528,226
Brookhaven	Mississippi	5,013	5,291	15,932
Katy	Texas	5,020	5,271	23,925
Old Ocean	do	5,954	5,117	54,101
Inglewood	California	4,416	5,101	169,994
West Cat Canyon	do	5,705	5,071	41,346
West Ranch	Texas	6,986	5,058	59,371

[1] Includes revisions.
[2] Bureau of Mines data.

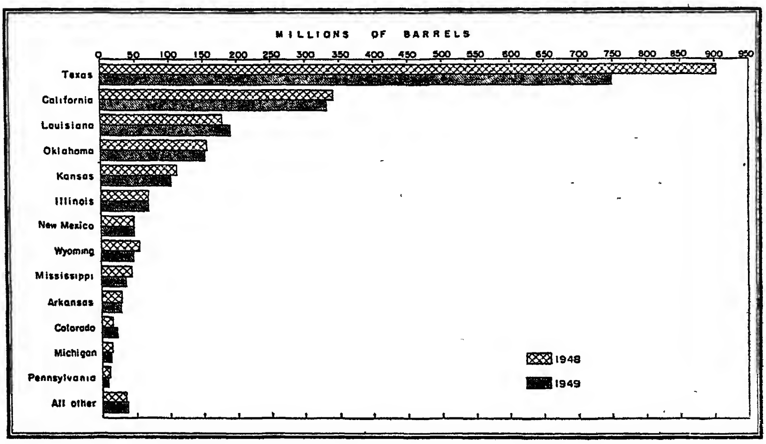

FIGURE 3.—Production of crude petroleum in the United States, 1948–49, by States.

completed in this field. The Curry pool, Ouachita County, was opened in July by a well drilled to the Travis Peak sand; the strike is 2½ miles north of production in the Stephens field. The well flowed over 400 barrels daily on official State test, producing from perforations at 3,608 to 3,620 feet. Subsequently five producers have been completed, most of them flowing or pumping over 100 barrels daily. Six dry holes have been drilled in the field.

TABLE 12.—Production of crude petroleum in Arkansas, 1945–49, by fields

[Thousands of barrels]

Field	1945	1946	1947	1948	1949 [1]
Atlanta	1,329	1,578	1,472	1,383	1,080
Buckner	614	544	654	861	778
Dorcheat-Macedonia	1,759	1,446	1,503	1,263	930
Fouke	878	957	985	1,037	945
McKamie	1,064	1,062	1,175	1,084	1,156
Magnolia	4,951	4,718	4,648	4,622	4,292
Midway	2,641	2,646	2,703	2,851	2,685
Schuler	4,733	4,419	4,022	3,820	3,170
Smackover	4,146	4,092	3,983	3,901	3,900
Stephens	2,035	1,866	1,475	1,278	1,511
Village	816	1,230	1,791	2,086	1,850
Wesson	9	622	1,793	3,084	2,638
Other fields [2]	3,638	3,195	3,744	4,412	5,001
Total Arkansas	28,613	28,375	29,948	31,682	29,936

[1] Preliminary figures.
[2] Includes oil consumed on leases and net change in stocks held on leases for entire State.

California.—Oil production declined moderately in 1949 (2 percent) compared with 1948, when output decreased to 332,839 thousand barrels. Several factors contributed to the drop, one being shutting in 3,000 wells producing heavy crude in 22 fields. Another cause was the earthquake at Wilmington resulting in casing damage to many wells at or near the 1,700-foot subsea level. Many fields reported declines, with such major fields as Coalinga, Kettleman Hills, and Wilmington, dropping 7, 8, and 10 percent, respectively. However, Ventura Avenue, Huntington Beach, and the New Cuyama Group fields increased production.

TABLE 13.—Production of crude petroleum in California, 1945–49, by districts and fields, in thousands of barrels

[American Petroleum Institute]

District and field	1945	1946	1947	1948	1949 [1]
San Joaquin Valley:					
Belridge	6,959	5,862	4,488	4,019	2,920
Buena Vista	15,772	14,756	17,265	16,596	13,907
Coalinga	31,681	32,105	33,754	35,818	33,266
Coles Levee [2]	7,030	6,335	7,225	6,591	7,239
Edison	2,166	5,316	4,124	4,107	4,126
Elk Hills	15,805	3,668	2,334	2,118	3,057
Fruitvale	3,096	2,723	2,391	2,383	2,720
Greeley	5,062	3,923	4,288	5,100	4,750
Helm	1,211	1,580	1,553	1,264	979
Kern River-Kern Front	8,210	6,826	6,979	8,240	6,934
Kettleman North Dome	14,357	13,849	13,480	12,832	11,739
Lost Hills	1,228	1,315	1,922	2,750	2,383
McKittrick	2,043	5,409	9,941	10,606	6,509
Midway-Sunset	14,334	15,318	15,660	15,165	12,758
Mountain View	1,024	1,369	1,894	1,307	1,199
Mount Poso	6,717	5,930	5,151	4,567	4,216
Raisin City	1,163	988	962	1,093	1,356
Rio Bravo	5,743	4,883	4,576	4,430	4,229
Riverdale	1,540	1,481	1,546	1,155	966
Round Mountain	3,507	3,352	3,085	2,700	2,438
Russel Ranch-South Cuyama				842	8,066
Tejon Ranch	161	487	1,187	1,133	861
Ten Section	4,095	3,229	2,829	2,379	2,351
Other San Joaquin Valley	8,227	8,492	9,280	9,650	9,811
Total San Joaquin Valley	161,131	149,196	155,914	156,845	148,780
Coastal district:					
Aliso Canyon	1,156	1,098	1,219	1,226	1,275
Del Valle	1,969	2,355	3,069	3,516	3,283
Elwood	2,172	2,454	2,576	2,682	2,681
Gato Ridge	1,615	1,421	1,314	1,279	1,150
Newhall-Potrero	1,996	2,111	2,397	2,726	3,185
Padre Canyon	753	904	1,179	2,092	2,655
Rincon	1,689	1,627	1,344	1,158	1,264
San Miguelito	1,940	1,835	1,874	1,832	2,350
Santa Maria	5,038	4,921	7,938	10,276	7,369
Santa Maria Valley	13,489	11,929	9,518	7,269	5,667
Ventura Avenue	17,701	16,906	17,754	17,738	21,040
Ventura-Newhall	2,285	2,542	3,369	4,016	9,412
Other Coastal	2,036	2,419	2,580	3,590	3,731
Total Coastal	53,839	52,522	56,131	59,400	65,062
Los Angeles Basin:					
Brea Olinda	4,195	3,945	4,449	5,286	5,213
Coyote	7,105	7,315	7,277	7,381	6,450
Dominguez	6,726	5,875	5,436	4,818	4,743
Huntington Beach	17,587	17,084	18,291	20,821	21,035
Inglewood	5,624	4,720	4,330	4,420	5,064
Long Beach	9,851	9,055	8,596	8,159	8,349
Montebello	3,665	3,129	2,696	2,467	2,346
Newport	[3] 385	1,804	2,630	2,412	2,242
Richfield	2,741	2,595	2,413	2,272	2,347
Rosecrans	2,095	1,840	1,684	1,695	[4] 2,247
Santa Fe Springs	6,278	6,117	5,914	5,512	5,327
Seal Beach	3,426	3,693	4,042	4,150	4,381
Torrance	3,241	3,126	2,938	2,862	2,762
Wilmington	36,192	40,171	47,674	48,317	43,509
Other Los Angeles Basin	2,401	2,436	2,717	3,257	2,982
Total Los Angeles Basin	111,512	112,995	121,087	123,829	118,997
Total California	326,482	314,713	333,132	340,074	332,839

[1] Preliminary figures.
[2] Includes Tupman.
[3] Includes Costa Mesa.
[4] Includes Athens.

Drilling activity likewise declined during the year, when 2,512 wells were drilled in contrast with 2,876 wells in 1948. The drilling effort resulted in 1,914 oil wells, 40 gas wells, and 558 dry holes. However, exploratory drilling attained a new record when 558 wells were drilled in 1949, or 100 more than during the preceding year; more than one-third of the exploratory drilling was in Kern County. This wildcatting resulted in the discovery of 3 new oil fields and 12 new oil zones in old fields. The most important new fields discovered during 1949 were Cuyama South and Placerita Canyon–Juanita area. The net result of wildcatting was disappointing as only 2.4 percent of exploratory wells were successful. With respect to reserves, Cuyama South is the first major field discovered since 1938. Placerita Canyon developed a high potential, which resulted in a large volume of oil being produced, but the reserve was greatly depleted during the first year of operation. The discovery well was completed in sec. 31–4–15, March 3, 1949, flowing 314 barrels daily of 22.2 gravity oil, total depth 1,831 feet. This well started a town-lot drilling campaign which was intensified during the fall by a decision of the Superior Court, which overthrew the well-spacing act and stimulated the drilling of 150 new wells. At the end of the year, 182 wells had been completed, with a pool production of 25,000 barrels daily.

Colorado.—Oil production soared to an all-time record in 1949, when output reached 23,934 thousand barrels, an increase of 35 percent or approximately 6.1 million barrels over the preceding year. The Rangely field was responsible for 6.0 million barrels of the increment. Fields which registered a loss in production during 1949 were Fort Collins-Wellington, Moffat, Walden, and Wilson Creek.

Drilling activity registered a sharp drop compared with 1948, as only 21 oil producers were completed contrasted with 149 the previous year. In spite of the decline in drilling, a lease campaign of major proportions progressed in the eastern part of the State. The outstanding strike of the year was a wildcat well drilled in Routt County, which found oil in a 29-foot sand between 6,670 and 6,699 feet in the lower Morrison horizon. Initial production was about 250 barrels daily of 38 gravity oil, and elevation is 9,000 feet above sea level on the Yampa anticline. The construction of a pipeline from the Rangley field to Salt Lake City, Utah, was instrumental in augmenting production in the field to an average of approximately 54,000 barrels per day.

TABLE 14.—Production of crude petroleum in Colorado, 1945–49, by fields

[Thousands of barrels]

Year	Fort Collins-Wellington	Hiawatha	Iles	Moffat	Price	Powder Wash	Rangely	Tow Creek	Walden	Wilson Creek	Other fields [1]	Total
1945	143	66	429	105	238	67	1,565	38	158	2,053	174	5,036
1946	135	45	441	93	239	24	8,128	39	188	2,381	143	11,856
1947	133	51	541	91	195	29	11,600	39	179	2,705	139	15,702
1948	127	62	534	112	164	35	13,881	41	129	2,602	175	17,862
1949 [2]	59	63	531	85	164	63	19,887	38	112	2,586	346	23,934

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.
[2] Preliminary figures.

Florida.—Oil production increased materially in 1949, with output of 441,000 barrels contrasted with 290,000 barrels the previous year. Three oil wells and one successful extension were completed in Collier County.

Exploration activity declined to 19 wells in 1949 compared with 24 wells the preceding year. The Sunniland field, Collier County, was responsible for the State's only production.

Illinois.—Crude production totaled 64,583 thousand barrels in 1949 compared with 64,808 thousand barrels the preceding year, indicating a decline of 0.3 percent. Among the fields recording gains were Albion, Centralia, East Inman, Robinson, and Sailor Springs. Losses were registered by the following fields—Boyd, Clay City, Johnsonville, Louden, Marine, New Harmony-Keensburg and Salem.

Drilling activity was maintained at a high tempo, with 2,706 wells completed; a breakdown reveals 1,392 oil wells, 6 gas wells, and 1,308 dry holes. Wildcat completions likewise increased in 1949, when 724 wells were drilled, of which 98 produced oil, 3 yielded gas, and 623 were failures.

TABLE 15.—Production of crude petroleum in Illinois, 1945–49, by fields, in thousands of barrels

[Oil and Gas Journal]

Field	1945	1946	1947	1948	1949
Albion	1,234	898	663	595	979
Boyd	1,372	1,497	1,313	1,210	1,062
Bridgeport	2,144	2,272	2,267	1,905	1,943
Centralia	1,729	1,887	1,456	1,251	1,712
Clay City	[1] 7,843	7,192	5,833	8,585	8,347
Dale-Hoodville	2,022	1,479	1,341	1,323	1,300
East Inman	598	561	343	1,102	1,905
Johnsonville	1,119	1,206	936	1,173	941
Louden	9,463	8,243	7,385	6,715	6,077
Marine	799	1,208	1,057	1,080	988
New Harmony-Keensburg	4,186	3,529	3,217	2,918	2,783
Patoka	1,574	1,651	1,345	769	607
Phillipstown	1,244	1,038	829	1,032	861
Robinson	1,095	1,118	1,100	1,236	1,381
Roland	936	752	641	1,154	1,049
Rural Hill	679	510	786	1,020	819
Sailor Springs	512	418	688	1,320	2,371
Salem	6,637	5,967	5,239	4,706	4,106
Other fields	28,274	33,187	29,021	24,938	24,855
Total Illinois	73,460	74,613	65,460	64,032	64,086

[1] Includes Schnell.

Indiana.—The State made a sharp increase in oil production in 1949, when 9,556 thousand barrels were produced compared to 6,974 thousand barrels the preceding year, an increment of 37 percent.

Drilling activity was greatly accelerated during the year, when 1,276 wells were drilled in contrast with 1,077 wells in 1948. Likewise wildcat completions made a large gain totaling 471 and resulted in 62 oil wells, 7 gas wells, and 402 dry holes. In 1948 only 307 wildcat wells were drilled. Over half of the successful wildcat wells were drilled in three counties—Posey, Gibson, and Sullivan.

TABLE 16.—Production of crude petroleum in Indiana, 1945–49, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945	425	387	360	359	427	407	428	442	387	417	402	427	4,868
1946	482	504	599	605	611	577	578	568	545	580	519	558	6,726
1947	538	476	532	522	520	501	516	503	492	504	484	507	6,095
1948	504	476	528	520	547	550	570	577	635	679	663	725	6,974
1949 [1]	667	620	735	734	855	792	804	839	806	920	890	894	9,556

[1] Preliminary figures.

Kansas.—A substantial drop in production (9 percent) was recorded in 1949 compared with the preceding year. Oil output totaled 101,868 thousand barrels, contrasted with 110,908 thousand barrels in 1948. The decline resulted from proration orders of the Kansas Corporation Commission. There was no let-up in drilling activity, as 3,356 wells were completed compared with 3,252 in 1948. Likewise, wildcatting continued at a high tempo, with 522 completions; 89 produced oil and 9 gas, and 424 were classified as failures.

In accordance with the usual pattern of Kansas fields, most of the discoveries opened up small pools. Almost half of the best strikes were made in four counties—Barton, Ellis, Stafford, and Butler. However, the outstanding new pools of the year were the Berland in Rooks County, the Huffstutter in Phillips County, and the Davis Ranch in Wabaunsee County; their combined production totaled over 66,000 barrels during November.

Of particular significance among the year's discoveries was the new Rhodes pool in Barber County, where the fifth well drilled in the pool had an initial potential of 9,000 barrels daily.

TABLE 17.—Production of crude petroleum in Kansas, 1945–49, by fields, in thousands of barrels

[Oil and Gas Journal]

Field	1945	1946	1947	1948	1949
Bemis-Shutts	5,160	5,305	6,057	5,748	4,560
Bloomer	2,902	2,749	3,045	3,161	2,492
Bornholdt	1,412	1,057	1,022	796	612
Burnett	3,189	2,873	3,120	4,996	3,497
Burrton-Haury	1,351	1,209	1,073	1,024	1,211
Chase	3,076	2,766	2,644	2,583	3,258
El Dorado	(1)	2,618	2,764	3,026	3,084
Geneseo-Edwards	3,181	3,220	3,733	3,519	2,803
Gorham	2,068	1,891	1,880	1,667	1,445
Hall-Gurney	3,410	3,455	3,414	3,485	3,433
Kraft-Prusa	[2] 4,590	5,257	6,425	6,871	5,463
Morel	1,076	1,098	1,641	1,717	1,399
Peace Creek	1,305	1,419	1,287	967	704
Ray	1,147	1,213	1,397	1,390	1,246
Ritz Canton	742	721	657	579	563
Silica-Raymond	6,422	5,691	5,783	5,387	5,092
Stoltenberg	[3] 2,740	2,747	2,804	2,483	2,098
Trapp	[4] 10,631	11,042	11,371	10,404	8,905
Zenith	2,912	1,521	849	583	427
Other fields	39,182	38,727	43,362	47,427	47,840
Total Kansas	96,496	96,579	104,828	107,813	100,132

[1] Included with "Other fields."
[2] Includes Feltes.
[3] Includes Wilkins.
[4] Includes Sellens.

Kentucky.—Production of 8,656 thousand barrels during 1949 reflected a 1.6-percent decrease from the previous year's output of 8,801 thousand barrels. Drilling activity for the State, as a whole, gained sharply in 1949 over 1948, evidenced by 1,043 wells drilled compared with 903 in 1948. This drilling resulted in 448 oil wells, 193 gas wells, and 402 dry holes.

In eastern Kentucky 186 wells were completed in proved territory; however, wildcatting in this part of the State met with no success. In western Kentucky, 346 oil wells were completed, including 29 wildcats. Greatest exploration activity was centered in Union, Daviess, Henderson, and McLean Counties.

TABLE 18.—Production of crude petroleum in Kentucky, 1945–49, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945	911	791	665	837	905	850	893	886	814	898	982	893	10,325
1946	866	835	929	907	940	897	922	906	866	875	812	823	10,578
1947	800	679	774	787	781	752	814	777	803	842	772	816	9,397
1948	748	706	801	663	736	732	738	728	726	746	730	747	8,801
1949 [1]	696	618	728	684	719	673	707	713	745	804	789	780	8,656

[1] Preliminary figures.

Louisiana.—All previous production records were again shattered in 1949, when crude output totaled 190,715 thousand barrels, a 5-percent gain over the previous record of 181,458 thousand barrels established in 1948. This trend was in direct contrast to some other large producing States which sharply curtailed their production of petroleum. The Gulf Coast production was 146,322 thousand barrels, a 6-percent gain over 1948, while the rest of the State produced 44,393 thousand barrels, an increment of 2 percent.

In northern Louisiana, fields making the largest increases in production in 1949 were Caddo, Haynesville and Lisbon, whereas individual fields suffering the biggest losses were Big Creek, Delhi, Ora, and Rodessa. During the year 1,444 wells were drilled in northern Louisiana, resulting in 927 oil wells, 192 gas wells, and 325 dry holes. This compares with 1,550 wells drilled in 1948, of which 1,095 were oil wells. The number of wildcat wells drilled declined from 114 in 1948 to 106 in 1949, a continuation of the trend during recent years. Wildcat wells were responsible for the discovery of six new oil fields and several new oil pay horizons in old fields, as well as extensions of old fields.

Noteworthy was the discovery of Wilcox production in the east central part of the State in Catahoula, Concordia, and La Salle Parishes, where four new oil fields were discovered. Of paramount importance was the new West Catahoula Lake field, where 25 oil wells were completed without defining the limits of the field. The wells are producing from a depth of 4,000 feet, which has been conducive to a rapid development program. Also producing from the Wilcox

sand are the new Chaney Lake and Vidalia fields of Concordia Parish, where drilling operations are not sufficiently advanced to determine the field's possibilities. Of more than passing interest was the rapid development of production in the Pettit lime in the Lisbon field, Claiborne Parish. Successful drilling operations were continued in the Haynesville, East Haynesville, Ruston, and Hico-Knowles areas.

In the Gulf coast area, individual fields that made the largest gains in production were Bay St. Elaine, Caillou Island, David Haas, Delta Farms, Golden Meadows, Section 28, University, and Weeks Island. Losses were reported in the following fields: Anse la Butte, Eola, Gibson, Hackberry, Jennings, Paradis, and Quarantine Bay. During the year, 923 wells were drilled in the Gulf coast region, a 20-percent increase over 1948. The total includes 597 oil wells, 19 gas wells, and 307 dry holes. There were 175 wildcats drilled in 1949 in the area covered by the Houma, Lafayette, Lake Charles, and New Orleans districts of the Louisiana Conservation Department. These districts include the offshore leases in the Gulf of Mexico. Of the 175 tests, 70, or 40 percent, were successful, which established a very high percentage of discoveries. Of the 70 discoveries, 50 were made by major companies and 20 by independents and smaller companies according to the Oil and Gas Journal. New fields resulted from 39 of the 70 successful wells, with new pay zones in old fields making up the balance.

New field discoveries in the Gulf of Mexico totaled 13 during 1949, augmenting the State's reserves of crude oil and natural gas. Largest number of discoveries was made in Cameron, Vermilion, Terrebonne, Lafourche, Jefferson, Iberia, and Plaquemines Parishes, on the Gulf. In addition to the 13 new fields discovered offshore, these parishes also included 10 new fields on land.

South Louisiana is an area of deep drilling and high pressures, which explains the very high drilling costs. Offshore drilling is unusually expensive due to the expense involved in building drilling platforms and transporting all equipment, fuel, and supplies over the water. Operators have been very successful in discoveries in the Gulf, and the percentage of strikes is high compared with other areas. All of the prospects now being drilled are in salt-dome formations, which are fairly easy to locate with underwater geophysical equipment. However, only the most favorable prospects are being drilled at this time.

Outstanding are the exceptionally deep wells being drilled in southern Louisiana with marked success. To mention a few—an oil strike was made at a depth of 13,000 feet in Jefferson Parish, two new horizons were discovered near 14,000 feet in Iberia Parish, and a new 14,-400-foot field was located in the Gulf in Lafourche Parish.

TABLE 19.—Production of crude petroleum in Louisiana, 1945–49, by districts and fields

[Thousands of barrels]

District and field	1945	1946	1947	1948	1949 [1]
Gulf coast:					
Anse la Butte	2,481	2,448	2,423	2,385	2,160
Avery Island	928	1,223	1,601	2,137	2,376
Barataria	1,367	1,523	1,932	3,255	3,468
Bay St. Elaine	227	380	817	1,495	2,055
Bayou Sale	2,903	3,479	4,445	5,221	4,996
Black Bayou	686	723	919	991	764
Bosco	1,000	1,068	960	900	876
Caillou Island	1,917	2,054	2,699	3,549	4,135
Charenton	1,048	1,200	1,580	1,514	1,512
David Haas			27	662	1,084
Delta Farms	3,372	4,510	5,539	6,818	7,581
East White Lake	1,219	1,427	1,357	1,333	1,217
Egan	417	1,453	2,054	2,441	2,381
Eola	2,467	1,721	1,370	1,156	835
Erath	1,193	1,204	1,194	1,233	1,246
Garden Island	1,139	1,168	1,295	1,353	1,509
Gibson	3,384	2,555	2,161	2,089	1,717
Golden Meadows	2,494	2,400	2,666	3,493	4,156
Good Hope	770	1,745	2,178	2,351	2,177
Grand Bay	3,033	3,122	3,433	3,729	3,590
Gueydan	2,071	2,200	2,008	2,072	2,115
Hackberry	3,776	3,794	4,000	4,264	3,626
Iowa	2,731	2,486	2,489	2,478	2,212
Jennings	2,442	2,025	1,809	1,492	1,207
Lafitte	4,139	4,374	4,362	4,107	4,017
Lake Chicot	773	922	1,349	1,201	1,083
Lake Pelto	913	1,302	1,429	1,558	1,584
Lake Salvador	1,595	1,632	1,623	1,665	1,842
Leeville	1,575	1,381	1,580	1,811	1,910
New Iberia	2,152	1,744	1,526	1,548	1,577
North Crowley	1,648	1,526	1,521	1,696	1,723
Paradis	3,652	3,688	3,728	3,936	3,698
Pine Prairie	1,942	1,821	1,546	1,409	1,416
Port Barre	1,008	1,103	1,375	1,636	1,456
Quarantine Bay	2,977	3,227	3,421	3,745	3,475
St. Gabriel	1,911	1,741	1,786	1,709	1,629
Section 28	225	230	364	518	1,103
Tepetate	1,931	2,936	3,402	3,935	3,977
University	1,982	1,884	1,976	2,097	2,844
Venice	3,315	3,030	3,638	4,174	4,614
Ville Platte	2,502	2,588	2,238	2,106	1,969
Vinton	2,703	3,372	3,654	3,578	3,740
Weeks Island	13	206	678	1,642	2,922
West Bay	1,222	1,246	1,691	2,108	2,281
West Cote Blanche	796	971	1,040	1,280	1,827
West Lake Verrett	1,004	1,136	1,357	1,379	1,393
White Castle	1,250	1,013	1,229	1,597	1,594
Other Gulf coast [2]	23,088	23,824	26,239	29,144	33,653
Total Gulf coast	107,381	112,805	123,708	137,990	146,322
Northern:					
Big Creek	35	908	1,892	1,963	1,664
Caddo	1,950	1,944	2,328	3,392	4,969
Delhi	1,054	5,525	8,041	8,576	7,545
Haynesville	2,356	3,321	3,500	4,405	5,339
Holly Ridge	1,429	1,254	1,162	1,025	960
Homer	976	926	924	893	855
Lake St. John	1,882	4,381	5,544	7,357	7,300
Lisbon	451	467	653	978	1,703
Nebo [3]	3,191	2,805	2,798	2,623	2,438
Olla [4]	3,636	3,109	2,921	2,794	2,580
Ora			674	2,997	1,896
Rodessa	2,515	1,978	1,727	1,509	1,302
Urania	632	615	675	854	950
Other northern [2]	3,563	3,631	3,581	4,102	4,892
Total northern	23,670	30,864	36,420	43,468	44,393
Total Louisiana	131,051	143,669	160,128	181,458	190,715

[1] Preliminary figures.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire district.
[3] Includes Hemphill, Trout Creek, and Jena.
[4] Includes Little Creek and Summerville.

Michigan.—The State's petroleum output totaled 16,495 thousand barrels in 1949, representing a 2-percent loss compared with the preceding year. Fields that increased production in 1949 were Beaver Creek and Pentwater, while losses were registered in the following fields: Coldwater, Deep River, Kimball Lake, and Reed City.

Drilling activity increased sharply in 1949 in comparison with the previous year; total completions equaled 925 wells, classified as follows: 426 oil wells, 23 gas well, and 476 dry holes. Of 344 wildcat completions, 28 struck oil, and 3 found gas. The leading counties were Allegan, Gladwin, and Van Buren, where over half the discoveries were made.

TABLE 20.—Production of crude petroleum in Michigan, 1945–49, by fields, in thousands of barrels

[Michigan Department of Conservation]

Year	Beaver Creek	Cold-water	Deep River	Fork	Kaw-kaw-lin	Kim ball Lake	Pent-water	Porter	Reed City	Stony Lake	Other fields	Total
1945	-------	958	1,460	1,566	654	-------	-------	521	4,267	-------	7,841	17,267
1946	-------	1,598	2,409	1,354	697	-------	-------	462	3,250	3	7,301	17,074
1947	15	1,746	2,872	752	725	868	-------	412	2,209	419	6,197	16,215
1948	370	2,212	2,885	422	804	1,614	392	381	1,282	849	5,660	16,871
1949 [1]	902	1,670	2,394	315	755	1,122	1,309	350	966	838	5,874	16,495

[1] Preliminary figures—estimated in part.

Mississippi.—The production of petroleum totaled 37,966 thousand barrels in 1949, compared with 45,761 thousand barrels the previous year, a drop of 17 percent. The principal oil fields, in order of their importance, are Tinsley, Mallalieu, Brookhaven, Cranfield, La Grange, Baxterville, and Heidelberg.

New wells drilled totaled 333, including 161 oil wells, 5 gas wells, and 167 dry holes. Wildcat completions totaled 115 wells, a slight gain over the 1948 total of 109 wells. Five oil fields and two gas-condensate fields were discovered during the year, all in southern Mississippi. According to reports, none of the strikes appeared to have major importance.

In Franklin County a strike was made by a well flowing 356 barrels of 43.8 gravity oil daily. The area has been named the Bude field. This well produced from a lower Tuscaloosa stringer sand at 11,090 to 11,098 feet. Six dry holes were drilled in the area, and by the end of 1949 only four wells were producing in the field.

A small strike was made by Humble Oil & Refining Co., in sec. 3, T. 4 N., R. 8 W., Greene County, in the southeastern part of the State. On initial test the well pumped 46 barrels per day of 24.6 gravity oil, producing from the lower Tuscaloosa sand at 7,804 feet to 7,812. It is the only well in the field.

In Adams County oil was found in the Wilcox sand at 6,465 to 6,469 feet in a wildcat well that gaged 360 barrels of 37 gravity oil per day. There are four producing wells in the field, which has been designated the Ellislie field.

TABLE 21.—Production of crude petroleum in Mississippi, 1945–49, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945	1,514	1,451	1,582	1,564	1,590	1,553	1,625	1,690	1,556	1,633	1,632	1,672	19,062
1946	1,697	1,554	1,663	1,707	1,918	1,921	1,981	2,220	2,207	2,384	2,425	2,621	24,298
1947	2,720	2,352	2,655	2,613	2,829	2,832	2,976	3,073	3,082	3,326	3,158	3,309	34,925
1948	3,526	3,419	3,702	3,652	3,817	3,760	4,027	4,021	3,856	4,069	3,956	3,956	45,761
1949 [1]	3,580	3,028	3,383	3,286	3,376	2,990	3,073	3,124	2,990	3,069	3,017	3,050	37,966

[1] Preliminary figures.

Montana.—Crude production totaled 9,149 thousand barrels in 1949 compared with 9,382 thousand barrels the previous year, a decrease of 2.5 percent. Principal oil fields that reported declines in 1949 compared with 1948, showed the following output: Cut Bank 3.5 million barrels, Cat Creek almost ½ million barrels, and Kevin-Sunburst 1.6 million barrels. The Pondera field produced over ½ million barrels, a substantial gain over 1948.

Well completions totaled 279, which resulted in 138 oil wells, 54 gas wells, and 87 dry holes.

Exploration activity declined during the year, when 45 wildcats were drilled contrasted with 57 wildcats in 1948. Four new oil fields, one gas-condensate field, one new gas field, and one new oil pool in an established producing field were discovered during the year. Operators made a determined effort to locate Devonian reef production; however, no outstanding strikes were reported in the State.

TABLE 22.—Production of crude petroleum in Montana, 1945–49, by fields

[Thousands of barrels]

Year	Big Wall	Cat Creek	Cut Bank	Dry Creek	Elk Basin	Kevin-Sunburst	Pondera	Ragged Point	Reagan	Other fields [1]	Total
1945		130	4,876	166	936	1,912	262			138	8,420
1946		480	4,546	160	1,355	1,772	306			206	8,825
1947		586	4,246	130	1,728	1,625	317			110	8,742
1948	2	510	4,074	105	2,415	1,623	361	93	61	138	9,382
1949 [2]	220	458	3,452	110	2,331	1,561	515	105	226	171	9,149

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.
[2] Preliminary figures.

Nebraska.—The production of crude oil increased to 330,000 barrels in 1949 in contrast with 215,000 barrels the previous year, a gain of 53 percent. Wildcat completions totaled 18, of which 3 were oil wells and 15 dry holes. In addition, seven oil wells were drilled in proved territory.

A leasing campaign of enormous proportions was carried on by several major oil companies in western Nebraska during the year. Outstanding was the strike of Ohio Oil Co. in its discovery of the Gurley field in Cheyenne County, southwestern Nebraska. The well [illegible] 225 barrels of 35 gravity oil per day from the first Dakota horizon at 4,401 to 4,429 feet. Five additional oil wells have since been completed in the field.

TABLE 23.—Production of crude petroleum in Nebraska, 1945–49, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945	25	28	21	31	28	26	26	26	22	27	19	26	305
1946	28	22	25	27	29	26	27	26	22	23	20	18	293
1947	23	18	18	17	17	18	19	17	21	20	20	21	229
1948	17	14	18	17	18	20	21	20	16	18	17	19	215
1949 [1]	21	18	20	20	17	18	28	23	25	49	41	50	330

[1] Preliminary figures.

New Mexico.—The record crude production in 1948 was equaled in 1949, when output again totaled almost 48 million barrels. The major producing fields were as follows: Drinkard, Monument, Vacuum, Eunice, Hobbs, Brunson, and Maljamar.

In southeastern New Mexico well completions totaled 486, resulting in 334 oil wells, 48 gas wells, and 104 dry holes; 66 wildcat wells were drilled, resulting in 14 oil producers and 52 failures. An intensive wildcat campaign was carried on in Lea and Eddy Counties which resulted in the discovery of 13 new oil fields, 11 being in Lea County. These strikes added materially to the crude-oil reserves of New Mexico. The principal discoveries were very deep wells producing from the Devonian pay at 10,500 to 12,500 feet, also from the Pennsylvanian pay at 9,000 to 9,600 feet.

Of outstanding importance was the Amerada Petroleum Co.'s discovery well in sec. 2, T. 12 S., R. 33 E., Lea County, with an initial production of 1,744 barrels daily, producing from the Devonian at 10,950 feet to 10,965 feet.

In northwestern New Mexico a wildcat well of prime importance was reported to have discovered oil in the Dakota sandstone in sec. 20, T. 24 N., R. 2 W., Rio Arriba County.

TABLE 24.—Production of crude petroleum in New Mexico, 1945–49, by districts and fields, in thousands of barrels

[Oil and Gas Journal]

	1945	1946	1947	1948	1949
Southeast:					
Arrowhead	1,839	1,691	1,547	1,460	1,289
Brunson	(1)	(1)	1,360	2,660	3,015
Drinkard	148	650	3,332	6,236	6,742
Eunice	5,707	6,007	5,796	5,360	4,414
Grayburg-Jackson	1,952	1,811	1,935	1,869	1,763
Hobbs	3,874	3,569	3,562	3,841	3,732
Maljamar	[2] 2,086	2,033	2,119	2,033	2,042
Monument	7,139	6,565	6,541	6,902	6,488
Paddock	65	655	1,298	1,584	1,568
Vacuum	4,585	4,054	4,099	4,504	4,449
Other	9,836	9,203	8,959	10,783	11,807
Northwest [3]	455	466	422	375	368
Total New Mexico	37,686	36,704	40,970	47,607	47,677

[1] Included with "Other".
[2] World Oil.
[3] Bureau of Mines.

The area formerly considered solely a natural-gas territory now has potentialities of oil production. This strike greatly accelerated leasing activity in the San Juan Basin. Although the well was not completed before the end of 1949, owing to a fishing job, preliminary tests indicate a 135-barrel well of 42.7 gravity oil producing from the second Dakota pay at 7,674 to 7,686 feet.

New York.—Oil production declined to 4,248 thousand barrels in 1949 compared with 4,621 thousand barrels the previous year, a drop of 8 percent. Completions for the year totaled 446 oil wells, all drilled in proved territory.

TABLE 25.—Production of crude petroleum in New York, 1945–49, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945	363	329	386	382	417	386	395	431	377	421	394	367	4, 648
1946	418	370	398	416	424	405	404	416	397	428	383	404	4, 863
1947	419	349	384	395	400	400	424	393	402	416	359	421	4, 762
1948	375	351	410	387	386	397	396	390	389	368	386	386	4, 621
1949 [1]	367	346	376	355	349	358	349	373	347	347	332	349	4, 248

[1] Preliminary figures.

Ohio.—Crude production declined 4.6 percent in 1949 compared with the preceding year; 3,433 thousand barrels were produced contrasted with 3,600 thousand barrels in 1948. A reduction in the price of crude oil was responsible for a sharp decline in drilling activity. Well completions totaled 1,044, exclusive of service wells, compared with 1,522 wells in 1948. In all 349 oil wells and 308 gas wells were completed during 1949.

No discoveries of particular significance were made in Ohio during the year. Drilling activity was greatest in the following counties: Perry, Ashland, Monroe, Washington, Muskingum, Knox, and Athens. The year's largest oil well was the Preston Oil Co. No. 1 Albert, Perry County, total depth 2,922 feet, which produced 275 barrels from the Clinton sand the first 24 hours after shot. In the Corning area, two field extensions were made, which added several hundred acres of production to the pools, one in Jackson Township, Knox County, the other in Jackson Township, Muskingum County.

TABLE 26.—Production of crude petroleum in Ohio, 1945–49, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945	195	208	258	233	251	246	248	265	229	258	223	214	2, 828
1946	234	214	242	248	260	245	238	243	242	260	235	247	2, 908
1947	236	201	244	266	256	264	282	259	274	291	250	285	3, 108
1948	259	251	309	302	303	312	317	324	309	305	298	311	3, 600
1949 [1]	258	267	304	282	283	316	276	310	288	288	283	278	3, 433

[1] Preliminary figures.

Oklahoma.—Oil production during 1949 dropped slightly; output totaled 151,902 thousand barrels contrasted with 154,455 thousand barrels in 1948, a 1.7 percent decline. Production gained in the Allen, Hewitt, Knox, Seminole City, Sholem-Alechem, Tatums and Witcher fields, whereas it decreased in the Apache, Burbank, Cement, Cumberland, Cushing, Healdton, Oklahoma City, Velma, and West Edmond fields.

There were 4,308 wells drilled in the State during 1949 compared with 4,263 the previous year, indicating a slight gain. Wildcat completions totaled 804, resulting in 163 oil wells, 18 gas wells, and 623 failures. The firm price structure for Oklahoma crude was maintained throughout the year, tending to stimulate exploration activity. This drilling resulted in the discovery of 77 new pools; however, many of these were small in extent.

TABLE 27.—Production of crude petroleum in Oklahoma, 1945–49, by fields, in thousands of barrels

[Oil and Gas Journal]

Field	1945	1946	1947	1948	1949
Allen	1,256	1,120	1,075	1,129	1,317
Apache	2,308	1,591	1,803	2,181	1,749
Beebe	723	661	619	601	740
Burbank	3,128	2,927	2,615	2,432	2,338
Cache Creek		668	2,328	1,945	1,780
Cement	5,165	4,801	4,442	4,552	4,207
Coon Creek		561	1,652	1,731	1,539
Crescent	1,845	1,557	1,321	875	635
Cromwell	1,277	1,094	671	641	591
Cumberland	4,119	3,696	3,948	3,955	3,275
Cushing	2,814	2,792	2,839	2,862	2,726
Edmond	902	583	545	470	434
Fitts	1,701	1,518	1,287	1,141	1,076
Glenn	2,359	2,418	2,568	2,610	2,587
Healdton	2,423	2,438	2,431	2,629	2,527
Hewitt	1,084	1,698	1,872	1,633	[2] 2,716
Knox	391	(1)	522	1,758	2,250
Lone Grove	984	388	1,497	1,199	1,023
Lucien	994	803	694	625	589
Oklahoma City	12,968	10,693	9,670	8,543	7,703
Pauls Valley	4,445	2,971	2,399	2,162	1,488
Ramsey	999	799	839	689	712
Seminole district:					
Bowlegs	1,250	1,169	1,172	1,262	1,176
Earlsboro	1,737	1,095	616	579	535
Little River	1,492	1,159	1,432	1,416	1,194
St Louis	[3] 1,703	[3] 1,500	1,356	1,330	1,283
Seminole City	1,990	1,307	1,271	1,086	1,441
Sholem-Alechem	751	708	723	5,196	6,497
Soldier Creek		187	1,218	1,890	1,048
South Burbank	2,370	1,886	1,455	1,076	901
Tatums	[4] 1,457	548	638	1,119	3,795
Velma	1,024	2,457	8,153	13,225	10,134
West Edmond	26,548	23,565	14,936	9,322	5,478
Witcher			30	1,497	2,094
Other fields	47,172	55,870	61,657	69,319	70,425
Total Oklahoma	139,379	137,228	142,094	154,680	150,003

[1] Included with "Other fields."
[2] Includes Bayou.
[3] Includes Pearson.
[4] Includes Tussy.

Of major importance is the Elk City area, Beckham County, which was discovered in December 1948. The field is now producing 5,000 barrels daily, with 13 producers, and the proved area is 8 miles long and 3 miles wide at its maximum width. The field produces high-gravity oil, and it is reported that a major company will erect a large natural-gasoline plant in the area.

Intensive development work was carried on in McClain and Garvin Counties, where approximately 360 wells are producing in 5 fields. Garvin County led the State in number of wildcat producers with 20, while Stephens County was second with 11 and Major, Okfuskee, and Seminole Counties were responsible for 10 each.

Of particular significance was extension of the Ringwood field, Major County, in the Anadarko Basin, where 19 producers were drilled in 1949. The field is now 7 miles long, and the exact limits have not been determined. Important extensions were made to Velma, Sholem-Alechem, and North Alma fields in Stephens and Carter Counties.

The development of new producing horizons in old fields of east central Oklahoma was noteworthy; good wells were completed in the Olive district and the South Slick pool of Creek County. A strike was made in Love County, southern Oklahoma, when a 200-barrel well was completed in sec. 36, T. 6S., R. 2E., flowing from 6,500-foot Pennsylvania sands. This well was responsible for an active leasing campaign in the county.

In Hughes County a wildcat well in sec. 14, T. 8N., R. 8E., was successful in opening up the Benjamin field by producing from the Cromwell sand at 3,303 to 3,312 feet; however, the extent of the field is unknown.

Pennsylvania.—Crude production decreased 10 percent during the year; output declined to 11,374 thousand barrels contrasted with 12,667 thousand barrels in 1948. A material decrease in drilling activity was registered, as evidenced by completion of 1,223 wells in 1949 contrasted with 1,889 wells the preceding year. The year's total included 956 oil wells, 215 gas wells, and 52 failures. No new oil fields were discovered during the year.

TABLE 28.—Production of crude petroleum in Pennsylvania, 1945–49, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945	1,015	919	1,096	1,043	1,109	1,097	1,082	1,111	996	1,089	995	963	12,515
1946	1,074	956	1,066	1,120	1,134	1,092	1,049	1,132	1,082	1,160	1,056	1,075	12,996
1947	1,110	920	1,017	1,069	1,081	1,057	1,110	1,056	1,072	1,120	994	1,084	12,690
1948	1,021	961	1,115	1,089	1,071	1,093	1,083	1,073	1,048	1,047	1,046	1,020	12,667
1949 [1]	983	916	1,029	970	956	959	919	980	922	940	884	916	11,374

[1] Preliminary figures.

Tennessee.—Oil production in 1949 increased slightly from the previous year's total of 19,000 barrels; however, drilling activity declined somewhat from the 1948 level. Crude oil was produced from six counties in the north and northeast-central part of the State.

Forty-seven wells were drilled during the year, 8 of which were successful. Two of these were wildcats and are producing from the Silurian in Sumner County; one was a new pool extension now producing from the Upper Stones River in Clay County, and the other five, also classed as new pool extension wells, are producing from the Chester in Morgan County. The second-deepest well ever drilled in Tennessee was Stephens Petroleum Co.'s deep test in McNairy County, reported to have been drilled to 5,280 feet; however, it was plugged in July.

Texas.—Crude production totaled 743,990 thousand barrels in 1949 compared with 903,498 thousand barrels the previous year, a drop of 159,508 thousand barrels, equivalent to 17.6 percent. Texas had the distinction of the largest decline in production of any of the States, as well as the greatest percentage decrease. This drop in crude output was due to the monthly proration orders of the Texas Railroad Commission. All districts except the Panhandle reported a substantial loss in production. Percentage losses in 1949 compared with 1948 were as follows: Gulf coast 24 percent, west Texas 16 percent, east Texas 19 percent, and rest of State 15 percent.

Drilling activity was maintained at a high level during 1949, when 13,619 wells were drilled in contrast with 12,172 wells the previous year. The most active district was west Texas, with 3,258 wells, while north central Texas was second with 2,571 and the Gulf coast third with 1,980.

Gulf Coast.—Crude production in the Gulf coast suffered the sharpest drop of any district in the State when output fell to 208,701 thousand barrels in 1949 compared with 274,440 thousand barrels in 1948, a 24-percent decrease. Oil fields reporting moderate gains in 1949 were Bloomington, Chocolate Bayou, Dyersdale, High Island, Hull, and Pierce Junction. Individual fields having large losses were Agua Dulce, Anahuac, Conroe, Friendswood, Hastings, Stratton, Thompson, West Ranch, and White Point.

During the year 1,980 wells were drilled, including 1,103 oil wells, 182 gas wells, and 695 dry holes. The number of wells drilled exceeded the 1948 total by approximately 100 wells, about evenly divided between oil and gas wells. Exploratory wells totaled 531 and resulted in 109 oil wells, 46 gas wells, and 376 dry holes. Notwithstanding the large number of strikes made during the year, the majority had minor significance. The East Village Mills oil field, Hardin County, appeared to be outstanding among the year's discoveries. It is producing from the Wilcox sand at approximately 7,000 feet, and the field is being rapidly drilled by 17 producers.

Of possible major importance is the New Ulm area in Austin County, where not only gas condensate has been found but also oil. The production is of dual-sand character, and the prospects are promising for Wilcox production on what is reportedly a very extensive structure.

TABLE 29.—Production of crude petroleum in Texas, 1945–49, by districts and fields

[Thousands of barrels]

District and field	1945	1946	1947	1948	1949 [1]
Gulf Coast:					
Agua Dulce	3,811	3,786	4,227	4,097	2,082
Amelia	1,491	1,493	1,581	1,581	1,111
Anahuac	11,168	10,137	10,663	10,832	7,103
Barbers Hill	1,895	1,853	1,969	1,944	1,964
Bay City	1,425	1,420	1,546	1,903	1,044
Bloomington	—	—	249	1,337	1,774
Bonnie View	352	811	1,178	1,299	856
Chocolate Bayou	629	1,064	1,613	2,863	3,529
Conroe	21,378	20,708	21,950	20,519	11,717
Dickinson-Gillock	2,138	2,077	2,000	2,287	2,368
Dyersdale	748	859	953	1,171	1,553
Fairbanks	2,644	2,287	2,232	2,272	2,016
Fannette	2,692	3,337	2,770	2,484	1,529
Fig Ridge	2,862	2,614	1,800	1,236	860
Friendswood	20,075	18,781	20,997	20,745	13,178
Greta	3,233	3,448	4,028	4,338	3,003
Hastings	20,961	19,317	21,279	21,643	14,317
Heyser	2,807	2,283	1,984	1,891	1,139
High Island	868	971	1,136	1,315	1,893
Hull	1,472	1,231	1,286	1,520	1,781
Humble	820	776	762	1,138	1,272
La Rosa	1,469	1,340	1,374	1,052	812
Livingston	1,273	1,712	1,895	1,898	1,353
Lolita	2,283	2,307	2,229	2,193	1,492
Lovell's Lake	1,765	1,806	1,556	1,595	1,169
Manvel	2,824	2,635	2,725	2,913	2,108
Markham	2,403	1,984	1,783	1,468	1,541
Midway	1,230	1,109	1,597	1,663	1,449
Old Ocean	6,107	6,088	5,473	5,983	5,096
Oyster Bayou	2,088	2,061	2,936	4,218	2,913
Pierce Junction	388	386	531	840	1,285
Placedo	2,324	2,177	2,222	2,281	1,700
Raccoon Bend	3,375	2,834	2,722	2,492	1,785
Refugio	1,918	2,418	3,203	3,119	2,440
Richard King	1,198	1,063	1,114	1,041	751
Saxet-Saxet Heights	2,142	2,498	2,595	2,519	2,044
Segno	1,355	1,282	1,276	1,161	850
Silsbee	867	1,137	1,064	1,114	1,176
Sour Lake	598	748	969	1,180	1,400
South Houston	1,785	1,558	1,592	1,641	1,417
Stowell	6,330	4,924	4,590	3,762	2,840
Stratton	4,016	3,604	4,344	4,625	3,233
Sugarland	2,448	1,721	1,691	1,859	1,186
Sugar Valley	—	276	1,479	2,421	2,079
Thompsons	13,007	13,136	15,621	16,927	11,763
Tomball	3,728	3,711	3,388	3,518	2,394
West Columbia	2,595	2,314	2,394	2,591	2,654
West Ranch	7,122	7,116	7,043	7,031	5,066
White Point	4,525	3,849	4,563	4,496	2,604
Withers-Magnet	7,391	6,847	5,655	5,850	4,160
Other Gulf Coast [2]	60,946	57,877	63,478	72,574	61,852
Total Gulf Coast	252,969	241,771	259,305	274,440	208,701
East Texas:					
East Texas proper [3]	131,204	120,789	117,112	112,284	93,951
Cayuga	2,633	2,456	2,285	2,098	1,991
Hawkins	12,436	14,914	17,045	17,609	11,464
Long Lake	2,042	2,072	2,122	2,223	1,491
Merigale	55	333	687	1,614	1,036
New Hope	1,640	1,284	1,481	1,617	1,894
Quitman	2,158	2,331	2,933	3,715	2,886
Rodessa	1,716	1,333	1,179	1,204	1,005
Sulphur Bluff	1,338	1,247	1,175	1,167	875
Talco	8,248	8,755	8,849	8,804	6,188
Van	10,968	10,625	10,443	12,110	8,313
Other East Texas	4,448	5,273	6,433	7,249	7,223
Total East Texas	178,886	171,412	171,744	171,694	138,317

[1] See footnotes at end of table.

TABLE 29.—Production of crude petroleum in Texas, 1945–49, by districts and fields—Continued

[Thousands of barrels]

District and field	1945	1946	1947	1948	1949 [1]
Central Texas:					
Charlotte	77	166	582	1,879	2,032
Darst Creek	3,188	2,595	2,541	2,574	2,521
Falls City	225	1,170	1,509	1,571	1,048
Luling	1,469	1,321	1,455	1,401	1,387
Mexia-Powell	1,209	1,144	1,124	1,038	977
Other Central Texas [4]	6,556	7,384	8,548	10,269	9,034
Total Central Texas	12,724	13,780	15,759	18,732	16,999
North Texas [5] [6]	54,255	57,204	61,768	69,951	69,764
Panhandle [7]	31,726	29,716	29,589	31,725	33,019
South Texas [8]	48,423	54,036	59,142	62,096	47,764
West Texas:					
Andrews	14,383	18,641	22,781	31,417	28,043
Crane-Upton	18,476	18,266	20,339	21,875	19,345
Coke			160	1,056	1,971
Crockett	2,020	3,794	7,050	8,496	6,931
Dawson	55	974	1,210	1,550	1,112
Ector [9]	34,180	38,532	50,392	67,518	53,814
Fisher	324	318	512	967	1,707
Gaines-Yoakum	32,909	30,726	35,915	41,417	29,098
Garza	151	1,215	1,631	2,586	2,605
Glasscock-Howard-Mitchell-Scurry	7,599	7,704	8,276	9,002	12,455
Hockley	24,119	21,444	19,950	29,697	26,503
King	90	578	1,138	1,088	759
Pecos	17,238	17,457	20,122	22,771	17,036
Reagan	3,011	2,808	2,798	2,669	2,389
Ward	6,919	6,750	6,631	6,739	4,833
Winkler	13,787	22,410	22,626	24,325	18,506
Other West Texas	466	679	1,372	1,687	2,319
Total West Texas	175,727	192,296	222,903	274,860	229,426
Total Texas	754,710	760,215	820,210	903,498	743,990

[1] Preliminary figures.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire district.
[3] Joiner, Kilgore, Lathrop, and other pools in Cherokee, Gregg, Rusk, Smith, and Upshur Counties.
[4] Includes other fields in Falls, Freestone, Limestone, and Navarro Counties.
[5] Includes the fields in and between Wilbarger, Wichita, Clay, Montague, and Cooke Counties on the north and Runnels, Coleman, Brown, and Comanche Counties on the south.
[6] Includes crude oil consumed on leases and net change in stocks held on leases for east (exclusive of East Texas proper) central, north, and south Texas.
[7] Carson, Gray, Hutchinson, Moore, and Wheeler Counties.
[8] Includes fields in Brooks, Duval, Hidalgo, Jim Hogg, Jim Wells, La Salle, Live Oak, McMullen, Starr, Webb, and Zapata Counties.
[9] Includes the part of Jordan pool in Crane County.

East Texas.—Petroleum production declined to 138,317 thousand barrels in 1949 contrasted with 171,694 thousand barrels in 1948, a decrease of 19 percent. With the exception of the New Hope field, production in all of the other fields dropped in 1949; the largest decrease occurred in the East Texas field, with a drop of over 18 million barrels. Other fields showing big declines were Hawkins, Quitman, Talco, and Van.

Drilling activity increased phenomenally during 1949, when 1,107 wells were drilled compared with 629 wells the previous year. Wildcat completions numbered 186 in contrast with 147 in 1948. There were 17 new oil strikes and 4 gas discoveries during the year. No outstanding discoveries were made in East Texas in 1949; however, Wood County led the district with three strikes, and Smith County was next with two successful wells.

Central Texas.—Oil production totaled 16,999 thousand barrels in 1949 compared with 18,732 thousand barrels in 1948, a decrease of 9 percent. The Charlotte field gained in output during the year, but there were declines in most other fields, including Falls City and Mexia-Powell. The district experienced intensified exploration activity during 1949, when 592 wildcat wells were drilled, resulting in 93 oil wells, 15 gas wells, and 484 dry holes. The most active counties were Throckmorton, Stephens, Coleman, Shackelford, and Jones.

North Texas.—Crude production amounted to 69,764 thousand barrels in 1949, which is almost identical to the preceding year's output of 69,951 thousand barrels. This district showed no signs of diminution in drilling activity during the year. Wildcat completions numbered 475, resulting in 83 oil wells, 6 gas wells, and 386 dry holes. The largest number of strikes was recorded in Archer County, with Jack and Young Counties tied for second place. Noteworthy were two discoveries in Jack County which produced 40 gravity sweet crude and apparently opened fields of considerable possibilities.

Panhandle.—Crude production increased to 33,019 thousand barrels in 1949 compared with the previous year's output of 31,725 thousand barrels, representing a 4-percent gain. The Panhandle was the sole district in the State where production increased in 1949.

Drilling activity in proved areas continued without abatement during the year and established a large gain over 1948. In all, 959 wells were drilled; 580 produced oil and 310 gas, and 69 were failures. No new discoveries of consequence were made during the year.

South Texas.—Oil production in 1949 was 47,764 thousand barrels contrasted with 62,096 thousand barrels the previous year, a decline of 23 percent.

Exploration activity was accelerated when 645 wildcats were drilled, which resulted in 74 oil wells, 34 gas wells, and 537 dry holes. The largest number of discoveries was made in Duval, Nueces, Starr, Brooks, Caldwell, and Frio Counties. No field of major importance was uncovered in the district; but many strikes were made, some of which have distinct possibilities. Of particular interest was the Clayton gas-condensate field, and reports indicate that it may develop into a major producing area. Eighteen wells were drilled in the London Gin field of Nueces County, which rated high in rapid development because of comparatively easy drilling. Many new pay zones were found, as well as extensions of old fields which opened up considerable additional proved territory.

West Texas.—Oil production declined 16 percent in 1949 contrasted with 1948, totaling 229,426 thousand barrels against 274,860 thousand barrels, a direct reversal of the trend during the preceding year. The counties responsible for the largest output were Andrews, Crane-Upton, Ector, Gaines-Yoakum, Hockley, Pecos, and Winkler.

Intensive drilling activity was responsible for a record number of wells being drilled in the area. Completions totaled 3,258 wells, resulting in 2,788 oil producers, 24 gas wells, and 446 failures. Wildcat wells numbered 343 and were responsible for 63 oil strikes, 6 new gas wells, and 274 dry holes.

Greatest activity was centered in Crockett, Gaines, Pecos, Runnels, Tom Green, and Scurry Counties. The outstanding discovery of the

year was the finding of reef oil in four new fields in Scurry County; moreover, the limits of these fields had not been defined by the end of 1949, although it was reported that a billion barrels of additional reserves had been discovered. Approximately 200 producing oil wells were completed during the year, and the exploration activity had been extended into Borden and Kent Counties. Reports indicate that the new fields may be joined, forming one enormous field 25 miles or more in length.

Utah.—Crude petroleum produced during the year amounted to approximately 613,000 barrels from three fields, the major production being from the Ashley Valley. The Roosevelt and Boundary Butte fields had less importance. A total of 49 wells was drilled in the State, including 25 oil wells and 1 gas producer.

A notable strike was the wildcat drilled in Uintah County by Carter Oil Co., which flowed over 1,600 barrels daily of 32.6 gravity oil from Tertiary formation at a total depth of 9,392 feet, with the top of the sand at 9,351. Production has been held to 600 barrels per day through choke, and pressure has remained constant.

Virginia.—The State output gained 10,000 barrels in 1949, when 43,000 barrels of crude oil were produced compared with 33,000 barrels in 1948. No development completions were made during the year, however, three wildcats were drilled, of which one was a gas well and the other two were failures.

West Virginia.—A moderate increase of 5 percent in crude production was made in 1949, when output totaled 2,839 thousand barrels compared with 2,692 thousand barrels the preceding year. In all, 518 wells were drilled during the year, classified as follows: 344 gas, 87 oil, and 87 dry holes.

The Silverton field, Jackson County, continued to maintain its position as the most active area for oil production in the State. Twenty-four oil wells were completed, averaging 15 barrels daily initial production, the average depth being 2,589 feet.

TABLE 30.—Production of crude petroleum in West Virginia, 1945–49, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945	251	218	261	236	246	238	242	264	223	244	236	220	2,879
1946	254	225	250	256	259	259	208	274	235	258	225	226	2,929
1947	227	183	220	202	211	209	218	219	229	253	208	238	2,617
1948	210	199	234	230	222	224	230	231	225	230	232	225	2,692
1949 [1]	212	209	233	226	235	238	236	254	247	260	247	242	2,839

[1] Preliminary figures.

Wyoming.—Oil production declined sharply in 1949 to 46,935 thousand barrels compared with 55,032 thousand barrels the previous year, a drop of 15 percent. Decreases were largest in the following fields: Big Sand Draw, Byron-Garland, Little Buffalo, Frannie, Hamilton Dome, Oregon Basin, Salt Creek, Steamboat Butte, and Winkleman.

Drilling activity continued at a high level during 1949, when 587 wells were drilled; a breakdown indicates the following: 322 oil wells,

8 gas wells, and 257 dry holes. In all, 131 exploratory wells were drilled, twenty-one of which were successful. The largest number of discoveries was made in Weston, Hot Springs, and Fremont Counties. Operators made a determined effort to locate oil in sands of Cretaceous age in the Powder River Basin, and their efforts were rewarded with eight discoveries. The oil is of high gravity, approximately 40°.

The outstanding drilling feat of the year was performed by the Superior Oil Co. in its Pacific Creek wildcat in Sublette County, which was drilled to a record depth of 20,521 feet in the Frontier sands of Cretaceous age. Although some gas shows were encountered, the well was finally abandoned.

TABLE 31.—Production of crude petroleum in Wyoming, 1945–49, by fields

[Thousands of barrels]

Year	Big Muddy	Big Sand Draw	Byron-Garland	Circle Ridge	Elk Basin	Frannie	Grass Creek	Hamilton Dome	Lance Creek	Little Buffalo
1945	549	263	3,752	218	3,190	1,487	1,016	957	5,503	290
1946	568	447	3,814	387	4,580	1,331	1,094	1,396	4,920	574
1947	668	1,462	4,653	439	4,696	1,711	1,042	2,196	4,294	982
1948	744	2,590	4,546	755	6,039	1,746	1,137	3,138	3,290	1,264
1949 [1]	832	2,290	2,908	818	6,050	1,395	899	1,485	3,262	598

Year	Lost Soldier-Wertz, etc.	Mush Creek	Oregon Basin	Rock Creek	Salt Creek	Steamboat Butte	Winkleman	Worland	Other fields [2]	Total
1945	3,135	--------	4,454	841	4,578	1,017	228	--------	4,741	36,219
1946	3,183	--------	4,164	853	4,642	1,888	385	--------	4,751	38,977
1947	4,003	179	4,009	867	4,566	2,800	507	313	5,385	44,772
1948	5,466	1,020	3,491	766	4,655	3,822	796	1,577	8,190	55,032
1949 [1]	5,568	1,060	1,604	741	3,937	2,317	521	2,946	7,704	46,935

[1] Preliminary figures.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.

WELLS

A record number of wells—37,656—was drilled in the United States during 1949 contrasted with 37,508 wells the previous year. Both totals include oil wells, gas wells, and dry holes. A generally firm price for crude oil throughout the year tended to maintain drilling operations at a high level.

Oil-well completions declined from 22,585 in 1948 to 22,042 in 1949, while the number of gas wells remained virtually constant, with 2,887 completions in 1949 compared with 2,897 the preceding year. Dry holes increased to 12,727 against 12,026 in 1948. Oil-well completions represented approximately 59 percent of the total wells drilled in 1949, dry holes comprising 34 percent and gas wells about 7 percent.

Texas led all States in number of wells drilled, with 13,619; Oklahoma was second with 4,308 wells and Kansas third with 3,356 wells.

By the end of 1948, there were 437,880 producing wells in the United States, with a daily average production per well of 12.8 barrels. Mississippi had the distinction of being in first place, with a

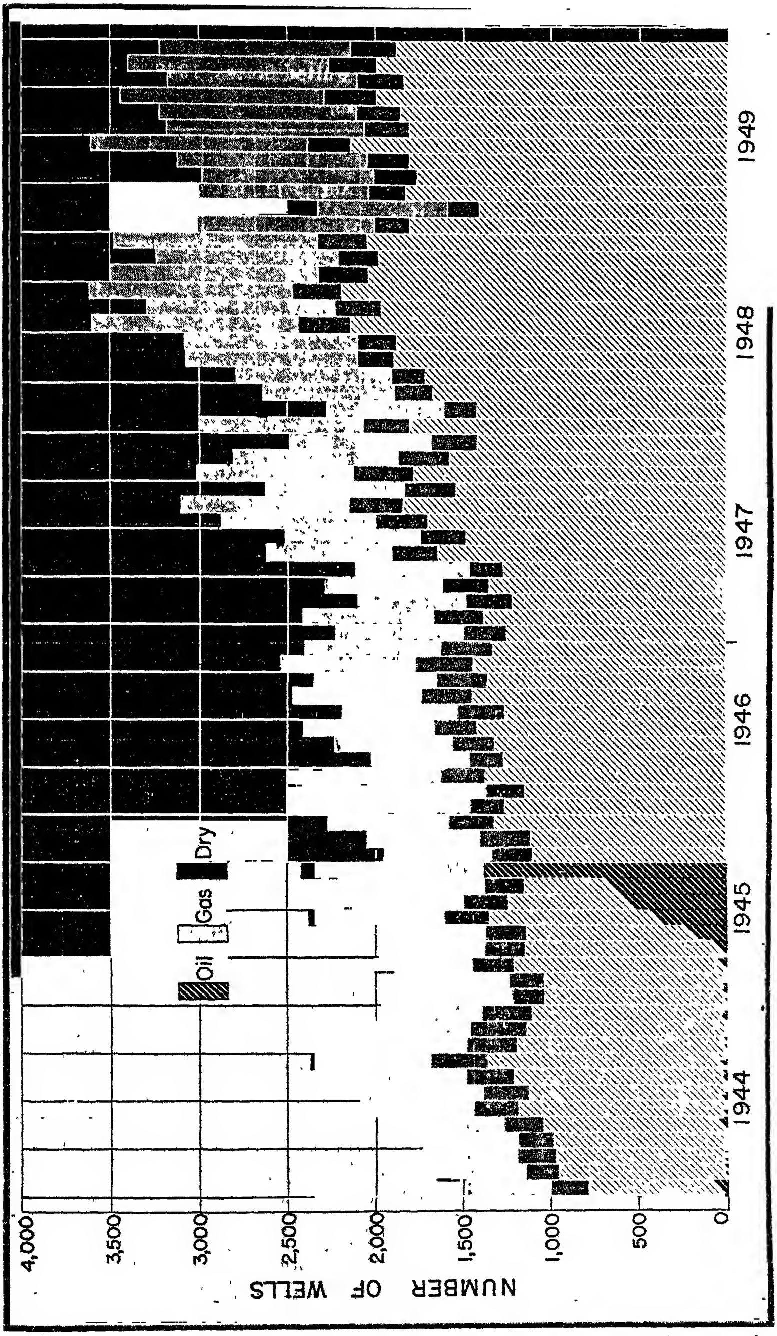

FIGURE 4.—Wells drilled in the United States, 1944–49, by months.

daily average production per well of 102.5 barrels, while the Louisiana Gulf Coast district was second with 93.3 barrels and Colorado next with 75.1 barrels.

TABLE 32.—Wells drilled for oil and gas in the United States, 1948–49, by months

[Oil and Gas Journal]

Wells	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total: Number	Total: Percent
1948														
Oil	1,786	1,418	1,665	1,701	1,870	1,859	2,129	1,957	2,176	2,024	1,964	2,036	22,585	60.2
Gas	265	183	215	196	213	222	292	251	285	280	226	269	2,897	7.7
Dry	957	665	741	876	991	997	1,172	1,077	1,143	1,191	1,040	1,176	12,026	32.1
Total	3,008	2,266	2,621	2,773	3,074	3,078	3,593	3,285	3,604	3,495	3,230	3,481	37,508	100.0
1949														
Oil	1,804	1,414	1,816	1,753	1,805	2,133	1,803	1,847	1,984	1,826	1,980	1,877	22,042	58.5
Gas	204	172	212	246	238	240	253	245	298	261	264	254	2,887	7.7
Dry	1,006	742	976	987	1,072	1,230	1,117	1,129	1,156	1,075	1,146	1,091	12,727	33.8
Total	3,014	2,328	3,004	2,986	3,115	3,603	3,173	3,221	3,438	3,162	3,390	3,222	37,656	100.0

TABLE 33.—Wells drilled for oil and gas in the United States, 1948–49, by States and districts

[Oil and Gas Journal]

State and district	1948 Oil	1948 Gas	1948 Dry	1948 Total	1949 Oil	1949 Gas	1949 Dry	1949 Total
Alabama	1		20	21	4		15	19
Arkansas	151	5	145	301	171	3	147	321
California	2,395	21	460	2,876	1,914	40	558	2,512
Colorado	149	10	48	207	21	4	57	82
Illinois	1,262	11	1,165	2,438	1,392	6	1,308	2,706
Indiana	518	40	519	1,077	521	30	725	1,276
Kansas	1,677	382	1,193	3,252	1,683	419	1,254	3,356
Kentucky	349	151	403	903	448	193	402	1,043
Louisiana:								
Gulf Coast	457	21	291	769	597	19	307	923
Northern	1,095	112	343	1,550	927	192	325	1,444
Total Louisiana	1,552	133	634	2,319	1,524	211	632	2,367
Michigan	355	30	435	820	426	23	476	925
Mississippi	250	16	161	427	161	5	167	333
Montana	191	69	85	345	138	54	87	279
Nebraska, Missouri, Iowa	18	3	35	56	12	6	31	49
New Mexico	433	44	129	606	334	53	114	501
Oklahoma	2,417	258	1,588	4,263	2,483	213	1,612	4,308
Pennsylvania, New York, Ohio, West Virginia	2,834	1,170	707	4,711	1,838	867	526	3,231
Texas:								
Gulf Coast	1,057	133	688	1,878	1,103	182	695	1,980
West Texas	2,756	31	464	3,251	2,788	24	446	3,258
East Texas	339	77	213	629	792	50	265	1,107
Other districts	3,467	301	2,646	6,414	3,930	490	2,854	7,274
Total Texas	7,619	542	4,011	12,172	8,613	746	4,260	13,619
Wyoming	394	7	183	584	322	8	257	587
Other States	20	5	105	130	37	6	99	142
Total United States	22,585	2,897	12,026	37,508	22,042	2,887	12,727	37,656

TABLE 34.—Producing oil wells in the United States and average production per day in 1948, by States and districts

State and district	Producing oil wells: Approximate number, Dec. 31	Producing oil wells: Average production per well per day (barrels)	State and district	Producing oil wells: Approximate number, Dec. 31	Producing oil wells: Average production per well per day (barrels)
Arkansas	3,670	23.8	New York	23,100	0.6
California	26,460	36.5	Ohio	20,000	.5
Colorado	700	75.1	Oklahoma	53,000	8.0
Illinois	26,500	6.8	Pennsylvania	82,000	.4
Indiana	2,780	7.5			
Kansas	27,900	10.9	Texas:		
Kentucky	14,750	1.6	Gulf Coast	15,600	48.8
			West Texas	23,600	33.7
Louisiana:			East Texas proper	22,900	13.3
Gulf Coast	4,170	93.3	Other districts	51,000	13.3
Northern	5,600	22.9			
			Total Texas	113,100	22.4
Total Louisiana	9,770	53.7	West Virginia	16,000	.5
Michigan	3,550	13.0	Wyoming	4,600	33.7
Mississippi	1,320	102.5	Other States [1]	160	15.6
Montana	3,100	8.6			
Nebraska	50	10.7	Total United States	437,880	12.8
New Mexico	5,370	25.3			

[1] Alabama, Florida, Missouri, Tennessee, Utah, and Virginia.

CONSUMPTION AND DISTRIBUTION

The indicated total demand for crude oil was 1,998.5 million barrels in 1949, a daily average decrease of 5.6 percent compared with 1948. The daily average production of crude oil declined 8.7 percent, the average amount imported rose 20.4 percent, and 3.3 million barrels were withdrawn from crude storage. Stocks of refined products were reduced 0.8 million barrels during the year. Crude supply and demand were thus in close balance in 1949, and a major part of the relative decline in crude-oil demand was due to the inflated demand for crude in 1948 (which resulted in the addition of 79.8 million barrels to stocks of refined products), as well as to the small decline in the total demand for all oils in 1949.

The indicated demand for domestic crude oil declined from 1,998.4 million barrels in 1948 to 1,842.5 million in 1949, a daily average decrease of 7.5 percent. The indicated demand for foreign crude oil increased from 124.9 million barrels in 1948 to 156.0 million in 1949, a daily average gain of 25.1 percent. The demand for foreign crude oil represented 5.9 percent of the total demand in 1948 and 7.8 percent in 1949.

The total demand for crude oil in 1949 included 1,945.5 million barrels of crude runs to stills at refineries or 97.3 percent of the total, and 53.0 million barrels of all other crude used, or 2.7 percent of the total. Because of the new method used in 1949 of reporting crude in California, involving a shift of a considerable part of the crude oil formerly reported as transfers to residual fuel oil to runs to stills at refineries, these percentages are not comparable with preceding years. Crude exports declined from 39.7 million barrels in 1948 to 33.1 million in 1949.

TABLE 35.—Runs to stills of crude petroleum in the United States in 1949, by districts and months [1]

[Thousands of barrels]

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
East Coast:													
Domestic	13,136	12,558	12,687	12,384	11,983	10,522	11,934	12,306	12,564	11,566	10,526	11,712	143,878
Foreign	11,989	9,866	11,126	9,682	11,287	10,308	11,160	10,801	10,753	12,463	12,278	14,766	136,479
Total East Coast	25,125	22,424	23,813	22,066	23,270	20,830	23,094	23,107	23,317	24,029	22,804	26,478	280,357
Appalachian	5,412	4,674	4,576	4,608	4,591	4,439	4,680	4,562	4,938	4,769	4,397	4,905	56,551
Indiana, Illinois, Kentucky, etc.	30,444	24,909	27,454	25,708	28,216	25,942	27,743	27,332	27,757	30,516	27,951	29,982	333,954
Oklahoma, Kansas, etc.	13,485	12,210	13,075	11,831	12,808	12,710	13,227	13,336	12,526	13,679	12,772	13,557	155,216
Texas Inland	7,211	6,499	6,808	6,389	6,882	6,511	7,025	6,759	6,431	6,428	6,207	6,131	79,281
Texas Gulf Coast:													
Domestic	42,035	37,856	38,384	35,688	35,908	35,300	35,852	36,612	37,793	38,609	37,290	40,056	451,383
Foreign	1,353	1,028	1,641	1,371	1,374	1,779	1,877	2,211	1,948	1,344	1,091	1,002	18,019
Total Texas Gulf Coast	43,388	38,884	40,025	37,059	37,282	37,079	37,729	38,823	39,741	39,953	38,381	41,058	469,402
Louisiana Gulf Coast:													
Domestic	13,667	12,000	13,430	12,899	12,621	11,990	12,479	13,180	13,670	14,330	13,277	14,107	157,650
Foreign						39	40	39					118
Total Louisiana Gulf Coast	13,667	12,000	13,430	12,899	12,621	12,029	12,519	13,219	13,670	14,330	13,277	14,107	157,768
Arkansas, Louisiana Inland, etc.	2,226	2,023	2,316	2,183	2,525	2,268	2,279	2,425	2,193	2,314	2,445	2,220	27,417
Rocky Mountain	5,510	4,557	5,484	4,647	4,942	5,432	5,817	6,057	6,140	5,079	5,224	5,771	64,660
California:													
Domestic	28,827	25,140	28,822	26,593	27,805	27,386	26,126	26,745	26,099	25,471	25,324	25,514	319,852
Foreign		120	116	240	111	235	119	120					1,061
Total California	28,827	25,260	28,938	26,833	27,916	27,621	26,245	26,865	26,099	25,471	25,324	25,514	320,913
Total United States: Domestic	161,953	142,426	153,036	142,930	148,281	142,500	147,162	149,314	150,111	152,761	145,413	153,955	1,789,842
Foreign	13,342	11,014	12,883	11,293	12,772	12,361	13,196	13,171	12,701	13,807	13,369	15,768	155,677
Grand total: 1949	175,295	153,440	165,919	154,223	161,053	154,861	160,358	162,485	162,812	166,568	158,782	169,723	1,945,519
1948	165,796	156,014	167,007	166,198	175,705	168,952	174,546	174,242	161,280	173,429	170,166	177,706	2,031,041
Daily average 1949	5,655	5,480	5,352	5,141	5,195	5,162	5,173	5,241	5,427	5,373	5,293	5,475	5,330

[1] Preliminary figures.

Runs to Stills.—To compare crude runs in 1949 with 1948, the figures for 1948 have been adjusted to the new basis used for California in 1949 by adding 17.3 million barrels to the original 1948 runs for California and the national total. On this new basis, total crude runs in 1949 amounted to 1,945.5 million barrels, or 5,330,000 barrels daily, as compared to 2,048.3 million barrels, or 5,597,000 barrels daily, in 1948—a total decline of 4.8 percent, including a decline of 5.4 percent for the districts east of California and a decline of 1.8 percent for the California district. The total decline in crude runs in 1949 was 102.8 million barrels, including declines of 40.2 million in the Texas Gulf district, 36.9 million in the East Coast district, 10.6 million in the Texas Inland district, 10.0 million in the Oklahoma-Kansas district, 6.6 million in the California district, 2.3 million in the Arkansas-Inland Louisiana district, 1.5 million in the Louisiana Gulf district, and 1.1 million barrels in the Appalachian district. The only increases were 4.7 million barrels in the Rocky Mountain district and 1.7 million in the Indiana-Illinois district.

Distribution.—The demand for domestic crude petroleum in 1949 amounted to only 1,842.5 million barrels or 5,048,000 barrels daily, a decline of 7.5 percent compared with 1948. The decrease in total demand for all oils, the gain in total imports, the increase in the production of light oils from natural gas, and a small reduction in stocks of crude and products all contributed to this decline. The demand for domestic crude oil was met by a production of 1,840.3 million barrels in 1949 and a decline of 2.2 million barrels in stocks of domestic crude oil. The supply of domestic crude oil was supplemented by a consumption of 156.0 million barrels of foreign crude—a gain of 31.0 million barrels compared with 1948. Imports of refined products, mostly residual fuel oil, increased from 59.1 million barrels in 1948 to 79.2 million in 1949. Stocks of refined products decreased 0.8 million barrels compared with the increase of 79.8 million in 1948. The production of natural gasoline and other light liquids increased from 147.1 million barrels in 1948 to 156.4 million in 1949.

The Bureau of Mines collects data relating to the receipts of domestic and foreign crude petroleum at refineries in the United States. These receipts provide the crude for total runs to stills at refineries, for small amounts of crude used as refinery fuel, and for any increase in crude stocks at refineries. Classification of the receipts by States of origin shows the amount received from local production (intrastate), the receipts from other States (interstate), and receipts of imported crude. The classification of receipts by methods of transportation indicates the final receipts by boat, pipeline, or tank cars and trucks. The receipts of domestic crude by boat were in most instances originally moved by pipeline from the point of production to the point of shipment by boat.

Receipts of domestic and foreign crude petroleum at refineries amounted to 1,945.5 million barrels in 1949 and, supplemented by a reduction of 3.5 million barrels in crude stocks at refineries, provided for total crude runs of 1,945.5 million barrels and crude used as fuel and losses of 3.5 million barrels. Receipts of foreign crude oil amounted to 154.9 million barrels or 7.9 percent of the total, interstate receipts of domestic crude oil were 722.9 million barrels or 37.2 percent

TABLE 36.—Demand for crude petroleum in the United States, 1946–49, by States of origin

[Thousands of barrels]

State	1946		1947		1948		1949 [1]	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
Alabama	382	1.0	408	1.1	441	1.2	492	1.4
Arkansas	28,068	76.9	29,511	80.8	31,569	86.2	30,109	82.5
California	310,094	849.6	330,830	906.4	336,554	919.5	328,525	900.1
Colorado	10,955	30.0	15,869	43.5	17,337	47.4	23,833	65.3
Florida	44	.1	168	.5	326	.9	345	.9
Illinois	75,851	207.8	71,828	196.8	61,531	168.4	65,384	179.1
Indiana	6,776	18.6	6,111	16.7	6,793	18.6	9,677	26.5
Kansas	96,743	265.0	106,200	291.0	109,624	299.5	102,890	281.9
Kentucky	10,399	28.5	9,963	27.3	8,728	23.8	8,163	22.4
Louisiana	145,050	397.4	160,352	439.3	179,423	490.2	189,405	518.9
Michigan	16,977	46.5	16,570	45.4	16,610	45.4	16,579	45.4
Mississippi	23,826	65.3	35,246	96.6	45,675	124.8	38,400	105.2
Montana	9,075	24.9	8,393	23.0	9,314	25.4	9,069	24.9
Nebraska	300	.8	226	.6	215	.6	315	.9
New Mexico	36,500	100.0	40,889	112.0	47,349	129.4	47,351	129.7
New York	4,860	13.3	4,741	13.0	4,612	12.6	4,257	11.7
Ohio	2,751	7.5	3,057	8.4	3,499	9.5	3,499	9.6
Oklahoma	139,878	383.2	144,379	395.5	153,664	419.8	150,811	413.2
Pennsylvania	12,724	34.9	12,812	35.1	12,178	33.3	11,333	31.1
Texas	757,211	2,074.6	810,557	2,220.7	898,157	2,454.0	752,089	2,060.5
Utah					16		599	1.6
West Virginia	2,875	7.9	2,701	7.4	2,597	7.1	2,900	7.9
Wyoming	36,679	100.5	45,545	124.8	52,066	142.2	46,402	127.1
Other States [2]	84	.2	123	.3	79	.2	113	.3
Total United States	1,728,102	4,734.5	1,856,479	5,086.2	1,998,357	5,460.0	1,842,540	5,048.1

[1] Preliminary figures.
[2] Missouri, Tennessee, and Virginia.

of the total, and intrastate receipts of 1,067.7 represented 54.9 percent of the total.

Refinery receipts of crude petroleum in 1949, by methods of transportation, indicated that 73.7 percent of the total was delivered by pipelines, 24.6 percent by boat, and 1.7 percent by tank cars and trucks.

Total deliveries to refineries by boat were 478.9 million barrels in 1949. The delivery of foreign crude totaled 154.9 million barrels, of which 136.5 went to the East Coast district, 17.4 million to the Texas Gulf Coast district, and 1.0 million to the California district. The interstate movement of domestic crude oil by boat amounted to 211.8 million barrels in 1949, including 140.0 million shipped from the Gulf coast to the east coast, 53.5 million of exchanges by boat between the Texas Gulf and Louisiana Gulf coast ports, and 18.1 million covering river shipments to Kentucky refineries. The intrastate deliveries by boat amounted to 112.2 million barrels in 1949, including 50.6 million in California, 32.5 million in the Louisiana Gulf, 25.7 million in the Texas Gulf, and 3.4 million in Kentucky.

Total receipts by tank cars and trucks in 1949 amounted to 32.8 million barrels, including 17.4 million intrastate and 15.4 interstate. The largest intrastate movements were 3.9 million barrels in California, 3.7 million in the Texas Gulf, 1.7 million in Wyoming, 1.6 million in Michigan, and 1.2 million in Kansas. The principal interstate movements were 3.6 million barrels to Illinois, 2.9 million to the Louisiana Gulf, 1.5 million to Inland Louisiana, 1.4 million to the Texas Gulf, and 1.3 million to Kentucky.

TABLE 37.—**Receipts of crude petroleum at refineries in the United States, 1945–49, by methods of transportation**

[Millions of barrels]

Method of transportation	1945	1946	1947	1948	1949 [1]
By boat:					
Intrastate	94.1	96.7	108.5	120.9	112.2
Interstate	113.3	226.2	241.0	265.1	211.8
Foreign	74.3	86.1	97.5	129.1	154.9
Total by boat	281.7	409.0	447.0	515.1	478.9
By pipelines:					
Intrastate	913.7	888.9	912.9	984.7	938.1
Interstate	454.2	401.4	449.7	490.0	495.7
Total by pipelines	1,367.9	1,290.3	1,362.6	1,474.7	1,433.8
By tank car and truck:					
Intrastate	15.2	20.1	19.9	24.0	17.4
Interstate	59.1	17.8	26.1	32.8	15.4
Total by tank car and truck	74.3	37.9	46.0	56.8	32.8
Grand total	1,723.9	1,737.2	1,855.6	2,046.6	1,945.5

[1] Preliminary figures.

Total receipts of crude oil at east coast refineries declined from 321.7 million barrels in 1948 to 280.2 million in 1949. Receipts of foreign crude oil increased from 123.6 million barrels in 1948 to 136.5 million in 1949, while total receipts of domestic crude declined from 198.1 million in 1948 to 143.7 million in 1949. The receipts of domestic crude oil included 140.0 million barrels by interstate boat movements, 3.3 million by pipeline from the Appalachian district, and 0.4 million by tank cars, and trucks. Receipts by interstate boat movements included 116.9 million barrels from Texas and 17.7 million from Louisiana. The total receipts of domestic crude oil in the East Coast district declined 54.4 million barrels in 1949 compared with 1948, including a decline of 55.2 million from Texas and a gain of 7.2 million from Louisiana.

The demand for domestic crude oil in 1949 totaled 1,842.5 million barrels, compared with 1,998.4 million in 1948, a decline of 155.9 million or 7.5 percent on a daily average basis. The comparison must be in daily averages because of the extra day in 1948. Of the 19 States with an annual demand of over 1 million barrels in 1949, only five States showed increases compared with 1948, including Louisiana with 10.0 million barrels, Colorado with 6.5 million, Illinois with 3.9 million, Indiana with 2.9 million, and West Virginia with 0.3 million. The major declines in demand were 146.1 million barrels for Texas, 8.0 million for California, 7.3 million for Mississippi, 6.7 million for Kansas, 5.7 million for Wyoming, 2.9 million for Oklahoma, and 1.5 million for Arkansas. The principal factors causing the decreased demand for domestic crude oil were the small decline in the total demand for all oils, the downward adjustment of refined products, and the decline in total exports and the gain in total imports. The demand for crudes high in lubricants was affected by the sharp drop in the total demand for lubricating oils, and the demand for heavy crudes was depressed because of the low demand for residual fuel oil, particularly for railroad use.

TABLE 33.—Daily average demand for total crude petroleum in the United States in 1948–49, by States of origin and by months

[Thousands of barrels]

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
1948													
Alabama	1.3		0.4	1.3	0.9	1.6	2.6	2.0	0.9	1.8	0.6	0.9	1.2
Arkansas	79.3	91.3	85.5	92.2	84.9	89.8	85.7	77.9	88.7	85.1	81.2	94.1	86.2
California	937.4	932.2	919.0	921.7	955.6	947.0	952.3	969.1	616.5	887.3	992.6	998.2	919.5
Colorado	46.2	43.4	42.3	43.9	47.3	54.6	44.5	44.5	50.1	46.7	45.4	59.4	47.4
Florida	.4	.2	.6	.3	1.1	1.8	.5	1.5	1.1	2.8	.2	.3	.9
Illinois	195.1	173.4	150.2	153.3	173.8	167.8	164.8	159.8	179.3	201.9	152.9	144.8	168.1
Indiana	15.2	16.5	16.7	15.5	17.2	17.9	17.6	17.5	23.0	23.1	19.8	22.6	18.6
Kansas	307.7	278.4	280.2	285.5	312.3	316.7	298.6	313.7	315.7	279.3	313.4	292.3	299.5
Kentucky	26.8	14.2	30.3	30.5	26.7	23.5	20.0	22.8	20.2	24.1	26.2	20.8	23.8
Louisiana	455.0	489.0	459.8	475.2	526.4	500.3	508.8	482.5	490.7	487.5	497.7	509.7	490.2
Michigan	45.9	44.2	45.8	41.7	45.1	44.0	43.0	46.6	48.7	44.9	45.6	49.1	45.4
Mississippi	108.7	112.9	119.5	127.6	132.2	120.2	120.4	128.1	122.1	143.8	135.4	126.0	124.8
Missouri, Tennessee, Utah, Virginia	.2	.2	.4	.3	.4	.2	.2	.2	.1	.4	.3	.3	.3
Montana	24.5	26.7	26.6	17.9	24.9	26.5	26.9	28.8	28.0	25.9	24.1	24.5	25.4
Nebraska	.6	.5	.6	.5	.6	.7	.7	.7	.6	.4	.6	.6	.6
New Mexico	125.8	113.0	130.5	146.8	139.3	125.5	117.8	115.6	144.2	129.1	129.2	135.5	129.4
New York	11.5	12.1	13.9	12.5	12.7	13.1	11.6	13.1	12.9	12.4	12.4	12.8	12.6
Ohio	8.6	10.4	10.3	10.3	9.0	9.9	7.2	8.0	9.5	7.8	12.9	10.9	9.6
Oklahoma	422.4	416.1	405.4	448.9	417.6	392.3	449.4	422.9	401.8	395.8	442.0	423.5	419.8
Pennsylvania	33.2	33.3	30.4	35.0	32.9	34.0	31.1	35.8	37.2	32.5	31.1	32.9	33.3
Texas	2,314.5	2,372.8	2,408.0	2,495.6	2,493.2	2,510.7	2,513.3	2,476.8	2,503.8	2,480.2	2,409.2	2,467.7	2,454.0
West Virginia	6.5	6.7	7.6	2.3	10.2	6.2	8.5	7.9	5.0	6.4	9.3	8.3	7.1
Wyoming	155.6	140.6	151.3	145.0	137.2	149.4	144.4	153.9	149.3	121.9	129.7	129.0	142.3
Total domestic	5,321.9	5,328.3	4,335.3	5,503.8	5,601.5	5,553.7	5,569.9	5,529.6	5,249.4	5,441.1	5,512.1	5,564.2	5,460.0
Foreign	269.6	270.1	271.3	300.9	340.0	316.4	343.1	370.4	394.7	393.5	402.2	421.3	341.4
Grand total 1948	5,591.5	5,598.4	5,606.6	5,804.7	5,941.5	5,870.1	5,913.0	5,900.0	5,644.1	5,834.6	5,914.3	5,985.5	5,801.4

1949 [1]													
Alabama	1.2	1.1	1.8	1.4	1.1	1.0	1.1	1.7	1.7	1.1	1.6	1.4	1.4
Arkansas	98.0	88.9	74.9	90.5	93.1	69.4	71.2	91.2	80.1	72.2	84.1	76.6	82.5
California	957.0	923.4	948.5	916.4	925.8	936.8	861.6	891.5	885.4	839.8	873.1	844.1	900.1
Colorado	61.3	67.5	64.4	60.4	57.5	69.9	69.6	62.1	70.5	65.9	66.6	68.4	65.3
Florida	.2	3.0	1.0	1.4	.9	1.5	1.1	1.8		.2	.1	.5	.9
Illinois	150.1	178.4	153.8	169.5	187.1	160.4	213.9	207.5	216.4	194.5	162.3	155.3	179.1
Indiana	23.3	22.8	21.4	25.0	27.5	26.6	26.5	27.2	27.4	30.2	30.5	29.4	26.5
Kansas	304.2	316.9	295.1	272.4	278.7	274.3	293.7	229.5	273.2	294.7	263.6	288.4	281.9
Kentucky	18.9	16.8	23.4	18.8	19.9	20.5	21.1	21.4	23.7	27.8	30.4	25.1	22.4
Louisiana	545.1	478.8	474.7	537.6	497.2	496.6	508.6	495.2	579.3	550.7	499.6	560.9	518.9
Michigan	48.0	47.4	45.9	36.3	45.4	43.3	36.7	49.7	51.3	48.6	44.1	48.4	45.4
Mississippi	109.7	112.9	112.4	98.8	103.0	108.8	97.5	113.1	101.7	102.7	93.0	108.9	105.2
Missouri, Tennessee, Virginia	.3	.2	.2	.3	.3	.2	.3	.4	.4	.4	.3	.3	.3
Montana	27.1	27.4	25.4	20.3	27.1	24.9	20.7	27.2	24.0	24.9	24.9	24.4	24.8
Nebraska	.7	.6	.7	.7	.4	.4	.9	.9	1.0	1.1	1.5	1.5	.9
New Mexico	138.8	122.7	129.9	148.7	104.7	121.7	138.4	168.0	132.8	115.2	121.6	113.9	129.7
New York	12.2	12.0	12.2	11.6	11.9	12.3	8.4	11.5	13.5	11.6	11.6	11.3	11.7
Ohio	10.6	8.3	6.7	8.6	9.5	9.7	10.9	11.7	10.0	9.7	10.1	9.0	9.6
Oklahoma	432.4	383.8	388.8	428.8	403.5	356.5	405.5	475.6	412.3	412.7	413.1	441.3	413.2
Pennsylvania	31.7	33.3	27.8	31.1	27.9	35.0	27.1	28.0	29.9	35.0	32.7	33.3	31.1
Texas	2,241.5	2,235.5	2,093.1	1,931.0	1,977.9	1,951.2	1,969.2	1,933.0	2,087.4	2,118.1	2,119.9	2,080.5	2,060.5
Utah	.2	.2	.4	.3	1.0	1.6	1.7	2.2	2.8	2.8	3.1	3.1	1.6
West Virginia	8.1	9.8	5.1	7.2	8.4	8.9	6.1	8.8	8.3	6.1	11.8	7.2	7.9
Wyoming	128.3	101.1	125.2	110.1	112.4	134.0	142.3	134.5	154.3	105.1	125.0	151.0	127.1
Total domestic	5,348.9	5,192.8	5,032.8	4,927.2	4,922.2	4,865.5	4,934.1	4,993.7	5,187.4	5,071.1	5,024.6	5,084.2	5,048.0
Foreign	422.9	394.2	416.1	377.0	414.0	411.8	426.6	425.3	423.6	445.9	446.1	510.9	427.3
Grand total 1949	5,771.8	5,587.0	5,448.9	5,304.2	5,336.2	5,277.3	5,360.7	5,419.0	5,611.0	5,517.0	5,470.7	5,595.1	5,475.3

[1] Preliminary figures.

TABLE 39.—Demand for total crude petroleum in the United States, 1948–49, by States of origin and by months

[Thousands of barrels]

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
1948													
Alabama	41	----------	13	39	28	48	79	63	28	56	17	29	441
Arkansas	2,457	2,654	2,651	2,765	2,632	2,695	2,657	2,415	2,651	2,638	2,437	2,917	31,569
California	29,060	27,033	28,489	27,650	29,624	28,411	29,522	30,042	18,494	27,507	29,778	30,944	336,554
Colorado	1,433	1,258	1,313	1,316	1,465	1,638	1,378	1,380	1,504	1,449	1,363	1,840	17,337
Florida	13	5	19	10	34	53	15	46	32	86	5	8	326
Illinois	6,049	5,029	4,656	4,598	5,387	5,035	5,110	4,953	5,380	6,258	4,587	4,489	61,531
Indiana	472	478	517	465	532	538	547	542	691	716	593	702	6,793
Kansas	9,537	8,075	8,687	8,564	9,680	9,502	9,257	9,726	9,472	8,659	9,402	9,063	109,624
Kentucky	815	412	939	916	829	706	621	707	608	746	785	644	8,728
Louisiana	14,106	14,182	14,253	14,256	16,318	15,010	15,774	14,958	14,722	15,112	14,932	15,800	179,423
Michigan	1,422	1,281	1,419	1,252	1,399	1,319	1,333	1,443	1,461	1,391	1,369	1,521	16,610
Mississippi	3,371	3,276	3,704	3,829	4,098	3,607	3,733	3,971	3,662	4,458	4,061	3,905	45,675
Missouri, Tennessee, Utah, Virginia	6	5	11	8	11	6	6	6	4	12	10	10	95
Montana	759	774	824	637	773	795	833	894	840	802	724	759	9,314
Nebraska	18	14	18	16	19	20	21	20	20	14	17	18	215
New Mexico	3,900	3,276	4,047	4,405	4,318	3,764	3,652	3,582	4,325	4,002	3,877	4,201	47,349
New York	357	351	430	376	394	394	361	406	388	386	371	398	4,612
Ohio	266	302	320	310	280	296	224	248	284	242	388	339	3,499
Oklahoma	13,094	12,067	12,569	13,465	12,946	11,768	13,932	13,111	12,054	12,269	13,261	13,128	153,664
Pennsylvania	1,029	966	942	1,050	1,020	1,020	963	1,111	1,115	1,009	934	1,019	12,178
Texas	71,750	68,811	74,648	74,868	77,288	75,319	77,911	76,780	75,115	76,885	72,284	76,498	898,157
West Virginia	201	195	235	68	317	185	262	246	152	199	278	259	2,597
Wyoming	4,823	4,078	4,690	4,350	4,255	4,481	4,475	4,767	4,481	3,778	3,890	3,998	52,066
Total domestic	164,979	154,522	165,394	165,113	173,647	166,610	172,666	171,417	157,483	168,674	165,363	172,489	1,998,357
Foreign	8,358	7,832	8,411	9,028	10,539	9,493	10,638	11,482	11,841	12,200	12,066	13,060	124,948
Grand total 1948	173,337	162,354	173,805	174,141	184,186	176,103	183,304	182,899	169,324	180,874	177,429	185,549	2,123,305
Daily average:													
Domestic	5,322	5,328	5,335	5,504	5,602	5,554	5,570	5,530	5,249	5,441	5,512	5,564	5,460
Domestic and foreign	5,592	5,598	5,607	5,805	5,941	5,870	5,913	5,900	5,644	5,835	5,914	5,985	5,801

1949 [2]													
Alabama	38	30	54	42	35	31	35	52	50	34	47	44	492
Arkansas	3,038	2,490	2,323	2,715	2,887	2,081	2,208	2,827	2,404	2,239	2,523	2,374	30,109
California	29,666	25,856	29,404	27,492	28,698	28,105	26,709	27,638	26,563	26,034	26,193	26,167	328,525
Colorado	1,901	1,891	1,995	1,810	1,784	2,096	2,156	1,924	2,116	2,043	1,998	2,119	23,833
Florida	5	82	32	41	28	44	33	56	1	5	3	15	345
Illinois	4,654	4,995	4,769	5,084	5,801	4,811	6,632	6,431	6,492	6,031	4,869	4,815	65,384
Indiana	723	639	664	752	854	798	821	843	821	935	915	912	9,677
Kansas	9,430	8,872	9,147	8,173	8,640	8,229	9,106	7,114	8,196	9,134	7,910	8,939	102,890
Kentucky	586	472	726	563	618	615	655	664	711	863	912	778	8,163
Louisiana	16,898	13,405	14,716	16,128	15,414	14,898	15,768	15,352	17,379	17,073	14,987	17,387	189,405
Michigan	1,489	1,327	1,422	1,090	1,406	1,300	1,136	1,540	1,537	1,507	1,324	1,501	16,579
Mississippi	3,400	3,162	3,484	2,965	3,194	3,264	3,023	3,508	3,051	3,184	2,790	3,375	38,400
Missouri, Tennessee, Virginia	8	6	7	8	9	8	10	13	11	13	10	10	[3] 113
Montana	839	767	787	609	841	747	643	843	719	771	746	757	9,069
Nebraska	21	18	20	21	12	13	28	28	30	35	44	45	315
New Mexico	4,303	3,434	4,027	4,460	3,244	3,651	4,289	5,208	3,984	3,571	3,648	3,532	47,351
New York	380	336	377	349	369	367	261	355	406	359	347	351	4,257
Ohio	328	232	208	260	294	291	337	364	302	302	301	280	3,499
Oklahoma	13,406	10,745	12,051	12,863	12,507	10,693	12,571	14,743	12,369	12,792	12,392	13,679	150,811
Pennsylvania	982	932	863	933	865	1,051	840	869	898	1,087	981	1,032	11,333
Texas	69,486	62,595	64,886	57,929	61,315	58,535	61,044	59,922	62,622	65,660	63,598	64,497	752,089
Utah	6	6	13	10	31	48	53	69	84	88	94	97	599
West Virginia	250	275	158	215	260	268	188	271	248	188	355	224	2,900
Wyoming	3,979	2,832	3,882	3,303	3,483	4,022	4,411	4,171	4,629	3,258	3,751	4,681	46,402
Total domestic	165,816	145,399	156,015	147,815	152,589	145,966	152,957	154,805	155,623	157,206	150,738	157,611	1,842,540
Foreign	13,366	11,037	12,900	11,312	12,834	12,353	13,224	13,183	12,707	13,824	13,382	15,838	155,960
Grand total 1949	179,182	156,436	168,915	159,127	165,423	158,319	166,181	167,988	168,330	171,030	164,120	173,449	1,998,500
Daily average:													
Domestic	5,349	5,193	5,033	4,927	4,922	4,866	4,934	4,994	5,187	5,071	5,025	5,084	5,048
Domestic and foreign	5,780	5,587	5,449	5,304	5,336	5,277	5,361	5,419	5,611	5,517	5,471	5,595	5,475

[1] Missouri (30), Tennessee (19), Utah (13), and Virginia (33).
[2] Preliminary figures.
[3] Missouri (48), Tennessee (22), and Virginia (43).

TABLE 40.—Distribution of crude petroleum in the United States in 1949, by States [1]

[Thousands of barrels]

State	Production	Refinery receipts of domestic crude, by origin							Runs to stills	Transfers to fuel
		Illinois	Kansas	Louisiana	New Mexico	Oklahoma	Texas	Other		
Alabama	462								1,001	
Arkansas	29,936			2,224				15,480	17,714	97
California, Washington	332,839							322,171	320,913	7,451
Colorado	24,547							5,944	5,955	63
Georgia, Delaware, Florida, South Carolina, Virginia	484						230	473	3,803	
Illinois, Minnesota, Wisconsin	64,583	21,427	13,421	372	7,143	25,610	46,208	4,684	118,711	501
Indiana	9,556	4,446	17,628		1,659	18,751	60,217	9,616	112,574	24
Kansas, Nebraska	102,198		52,131		20	6,614	2,224	1,023	62,049	261
Kentucky, Tennessee	8,678	2,825		7,453				14,048	24,145	47
Louisiana:										
Gulf	146,322			85,954			36,816	34,183	157,768	858
Inland	44,393			3,316			190	6,289	6,518	206
Maryland				735			5,340	44	15,032	
Massachusetts, Rhode Island				590			4,502		11,851	
Michigan	16,495	3,700				475	7,848	16,305	28,190	56
Mississippi	37,966								2,184	83
Missouri	46		865			1,575	8,706	1,610	12,808	42
Montana	9,149							13,678	13,223	12
New Jersey				5,990	983	759	38,348	3,957	96,822	
New Mexico	47,932				3,421		912		4,317	206
New York:										
East							1,409	2,956	14,043	
West	4,248	1,647	60				6,735	3,429	11,932	
Ohio:										
East	3,433	12,971		1,053		489		8,643	23,136	390
West		13,991	265	2,157		13,092	15,803	4,822	50,334	
Oklahoma	151,902		8,933		156	61,378	9,564		80,359	450
Pennsylvania:										
East				10,343			67,081		138,806	
West	11,374	251				1,604	2,707	12,298	16,934	2
Texas:										
Gulf	208,701			61,808	32,271	1,149	356,518	53	469,402	626
Inland	535,289			27	2,420	1,397	74,754		79,281	1,680
Utah								14,869	14,913	
West Virginia	2,839	46				1,554		2,903	4,549	
Wyoming, Idaho	46,935							25,801	26,252	130
Total	1,840,307	61,304	93,303	182,022	48,073	134,447	746,112	525,279	1,945,519	13,185

[1] Preliminary figures.

The market demand for Texas crude oil declined from 898.2 million barrels in 1948 to 752.1 million in 1949, a decline of 146.1 million or 16.0 percent on a daily average basis. Stocks of Texas crude oil decreased 8.1 million barrels in 1949. The relative contribution of Texas to the total demand for domestic crude oil declined from 45.0 percent in 1948 to 40.8 percent in 1949. The deliveries of Texas crude oil to refineries in the United States declined 137.4 million barrels in 1949, including decreases of 64.4 million to Texas refineries, 55.2 million to east coast refineries, 14.5 million to Louisiana refineries, and 5.6 million to refineries in the Oklahoma-Kansas district. There was no change in total deliveries to the Indiana-Illinois district and a gain of 2.4 million barrels to the Appalachian district. The low demand for Texas crude oil in 1949 was due to a decline in total demand for all oils, particularly in exports; to sharp declines in total crude runs in Texas and the east coast due, in part, to excess stocks of refined products; to the increase in imports of crude oil and products in areas served by Texas crude oil; and to a better-maintained market for crude oil in some of the States competing with Texas.

California ranked second as a source of crude-oil supply in the United States, with a market demand of 328.5 million barrels in 1949 compared with 336.6 million in 1948, a decline of 8.1 million or 2.1 percent on a daily average basis. California supplied 17.8 percent of the total demand for domestic crude oil in 1949 compared with 16.8 percent of the total in 1948. Stocks of California crude oil increased 4.3 million barrels in 1949. Stocks of refined products in the Pacific coast area rost 13.5 million barrels in 1949 compared with a gain of 12.7 million in 1948. Excess supplies of products led to the shipment of 7.6 million barrels to the east coast in 1949 compared with shipments of 2.1 million in 1948. The major part of the increase was residual fuel, the local demand for which had been cut by a sharp drop in railroad purchases. The increased competition of natural gas has been a further factor affecting the demand for California oil.

Louisiana was the third largest source of domestic crude oil in the United States, supplying 10.3 percent of the total demand in 1949 compared with 9.0 percent in 1948. The demand for Louisiana crude oil rose from 179.4 million barrels in 1948 to 189.4 million in 1949, a gain of 10.0 million or 5.9 percent. Stocks of Louisiana crude increased 1.3 million barrels in 1949, compared with a gain of 2.0 million in 1948. Total deliveries to refineries of Louisiana crude amounted to 182.0 million barrels in 1949, including intrastate deliveries of 89.3 million and interstate deliveries of 92.7 million. The principal shipments to other States included 61.8 million barrels to Texas refineries, 17.7 million to east coast refineries, and 10.0 million to the Indiana-Illinois district.

Oklahoma ranked fourth in supplying the demand for domestic crude oil in 1949, furnishing 8.2 percent of the total compared with 7.7 percent in 1948. The total demand for Oklahoma crude oil declined from 153.7 million barrels in 1948 to 150.8 million in 1949, a decrease of 1.6 percent on a daily average basis. Stocks of Oklahoma crude oil rose 1.1 million barrels in 1949. Deliveries to refineries in 1949 totaled 134.5 million barrels, including 61.4 million to refineries

within the State, 57.9 million to the Indiana-Illinois district, 8.2 million to other States in the Oklahoma-Kansas district, 3.6 million to the Appalachian district, 2.6 million to Texas refineries, and 0.8 million to New Jersey.

Kansas ranked fifth as a source of domestic crude oil in 1949. Demand for Kansas crude declined from 109.6 million barrels in 1948 to 102.9 million in 1949, a decrease of 6.7 million or 5.9 percent on a daily average basis. Kansas crude-oil stocks were reduced 1.0 million barrels in 1949 compared with a gain of 1.3 million in 1948. Total deliveries to refineries amounted to 93.3 million barrels in 1949, including 52.1 million to refineries in the State, 31.3 million to the Indiana-Illinois district, and 9.8 million to Oklahoma and Missouri refineries.

Illinois ranked sixth in importance as a source of crude oil in 1949, supplying 3.5 percent of the total demand for domestic crude oil compared with 3.1 percent in 1948. Demand rose from 61.5 million barrels in 1948 to 65.4 million in 1949, a daily average gain of 6.4 percent. Total deliveries to refineries amounted to 61.3 million barrels in 1949, including 21.4 million to refineries in the State, 25.0 million to the other States in the Indiana-Illinois district, and 14.9 million to the Appalachian refineries. Stocks of Illinois crude were reduced 0.8 million barrels in 1949 compared with an increase of 3.3 million in 1948.

New Mexico replaced Wyoming as the seventh State in importance in supplying crude oil in 1949, increasing the demand for its crude oil from 2.4 percent of the national total in 1948 to 2.6 percent in 1949. Stocks of New Mexico crude increased 0.6 million barrels in both 1948 and 1949. The demand for New Mexico crude oil was 47.4 million barrels in both years but gained 0.2 percent in daily average. Only 3.4 million barrels were used by refineries in the State in 1949. The principal outside markets were in Texas and Illinois refineries.

The next three States in order of importance as a source of domestic crude oil in 1949 were Wyoming with 2.5 percent of total demand, Mississippi with 2.1 percent, and Arkansas with 1.6 percent of the total. Compared with 1948, the demand for Wyoming crude decreased 10.6 percent, for Mississippi crude 15.7 percent, and for Arkansas crude 4.3 percent. The demand for the heavy crudes produced in these States fell because of the decline in the demand for residual fuel oil in 1949.

The demand for Colorado crude oil representing 1.3 percent of the national total in 1949 compared with 0.9 percent in 1948, increased from 17.3 million barrels in 1948 to 23.8 million in 1949, a gain of 6.5 million or 37.8 percent. Improved pipeline facilities and the increase in refinery capacity in Utah permitted a major increase in the amount of crude oil marketed in 1949.

Compared with 1948, the demand for Michigan crude oil showed no change in 1949, the demand for Pennsylvania crude continued the slow decline since 1947, the demand for Indiana crude increased 42 percent, the demand for Montana crude decreased over 2 percent, and the demand for Kentucky crude declined 6 percent.

STOCKS

Changes in the stocks of all oils are an essential indication of the relation between supply and demand. The increase of 107.1 million barrels in the stocks of all oils in 1948, including gains of 26.0 million in crude stocks and 81.1 million in other stocks, was initiated after the temporary and local shortages during the cold weather in the first quarter of the year and was accentuated by a smaller demand for all oils than had been expected in the latter part of 1948. Abnormally mild weather continued during the first quarter of 1949 and reduced the demand for heating oils and kept stocks at refineries, bulk terminals, and those held by distributors and consumers at abnormally high levels. As a result, refinery operations were cut sharply in the second quarter of 1949; and in the fourth quarter, total crude runs were 115,000 barrels daily below the rate in the first quarter.

Stocks of all oils totaled 602.9 million barrels on December 31, 1949, compared with the new basis of 605.7 million on the first of the year. The decrease of 2.8 million barrels during the year included a decline of 3.3 million in total stocks of crude oil, a gain of 1.3 million in stocks of natural gasoline, and a decrease of only 0.8 million in stocks of refined products.

The change in crude stocks in 1949 represented a decline of 2.2 million barrels in domestic crude stocks and a decline of over 1.0 million in foreign crude stocks. The principal declines in domestic crude stocks by States of origin were 8.1 million barrels for Texas, 1.0 million for Kansas, and 0.8 million for Illinois. The largest gains were 4.3 million barrels for California, 1.3 million for Louisiana, and 1.1 million for Oklahoma.

The decline of only 0.8 million barrels in stocks of refined products in 1949 included gains of 8.1 million in stocks of finished gasoline and 3.8 million in stocks of distillate fuel oil and declines of 3.8 million for residual fuel oil and 3.1 million for kerosine stocks.

Total refined stocks in the California district increased 13.5 million barrels in 1949 and declined 14.3 million in districts east of California. The excess of product stocks in the Pacific coast led to a substantial gain in shipments of surplus products from this area to the eastern United States via the Panama Canal.

TABLE 41.—Stocks of crude petroleum, natural gasoline, and refined products in the United States at end of year, 1945–49

[Thousands of barrels]

Product	1945	1946	1947	1948	1949 [1]
Crude petroleum (refinable):					
At refineries	50,276	53,113	52,864	60,969	60,405
Pipeline and tank-farm	153,957	156,238	156,726	169,508	177,049
Producers	14,530	15,122	15,339	16,095	15,902
Total refinable	218,763	224,473	224,929	246,572	253,356
California heavy crude	4,496	5,703	5,725	10,055	
Total crude petroleum	223,259	230,176	230,654	256,627	253,356
Natural gasoline	4,322	4,981	4,296	5,579	6,831
Refined products	235,998	271,937	267,103 [2] 265,850	345,650 [2] 343,537	342,704
Grand total	463,579	507,094	502,053 [2] 500,800	607,856 [2] 605,743	602,891

[1] Final figures. Separation between "gasoline-bearing" and "heavy" in California discontinued in 1949.
[2] New basis for comparison with subsequent years.

TABLE 42.—Stocks of crude petroleum in the United States in 1949, by States of origin and by months [1]

[Thousands of barrels]

State of origin	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
Alabama	51	51	56	41	33	33	38	39	24	16	20	16	21
Arkansas	3,363	2,956	2,905	3,233	3,086	2,850	3,120	3,185	2,759	2,694	2,897	2,924	3,190
California	33,627	33,117	33,774	33,812	34,591	34,636	34,152	35,558	35,701	36,080	37,231	37,187	37,941
Colorado	1,825	1,965	1,869	1,829	2,044	2,240	2,079	2,084	2,265	2,140	2,141	2,099	1,916
Florida	72	106	57	61	64	75	72	83	72	102	126	154	168
Illinois	12,765	13,274	13,120	13,831	13,995	13,703	14,261	13,040	12,260	11,276	10,735	11,299	11,964
Indiana	310	254	235	306	288	289	283	266	262	247	232	207	189
Kansas	9,625	8,991	8,210	8,446	9,000	9,211	9,264	7,922	8,779	8,676	8,132	8,873	8,603
Kentucky	1,057	1,167	1,313	1,315	1,436	1,537	1,595	1,647	1,696	1,730	1,671	1,548	1,550
Louisiana	13,481	12,749	13,993	15,165	14,627	15,792	16,319	15,963	16,067	13,910	13,525	15,107	14,791
Michigan	1,140	1,114	1,056	1,040	1,288	1,170	1,191	1,388	1,261	1,145	1,045	1,088	1,056
Mississippi	2,556	2,736	2,602	2,501	2,822	3,004	2,730	2,780	2,396	2,335	2,220	2,447	2,122
Missouri, Nebraska, Utah	27	24	27	24	28	42	49	54	52	41	67	63	64
Montana	1,071	993	882	905	1,111	1,105	1,165	1,316	1,233	1,253	1,224	1,204	1,151
New Mexico	6,937	6,699	7,064	7,253	6,729	7,608	7,966	7,610	6,365	6,195	6,689	6,997	7,518
New York	188	175	185	184	190	170	161	249	267	208	196	181	179
Ohio	797	727	762	858	880	869	894	833	779	765	751	733	731
Oklahoma	27,375	27,449	28,535	29,545	29,313	29,762	31,232	30,736	28,380	28,126	28,313	28,924	28,466
Pennsylvania	1,767	1,768	1,752	1,918	1,955	2,046	1,954	2,033	2,144	2,168	2,021	1,924	1,808
Texas	119,471	122,338	125,032	127,099	127,912	126,409	125,316	120,280	117,722	114,482	111,429	113,256	111,372
West Virginia	570	532	466	541	552	527	497	545	528	527	599	491	509
Wyoming	10,422	10,568	10,978	10,906	11,408	11,831	11,703	11,291	11,277	10,756	11,310	11,399	10,955
Total domestic	248,497	249,753	254,873	260,813	263,352	264,909	266,041	258,902	252,289	244,872	242,574	248,121	246,264
Foreign	8,130	8,895	10,343	8,528	9,168	9,003	8,650	8,684	8,296	6,817	8,235	7,889	7,092
Grand total	256,627	258,648	265,216	269,341	272,520	273,912	274,691	267,586	260,585	251,689	250,809	256,010	253,356

[1] Preliminary figures.

TABLE 43.—Stocks of crude petroleum in the United States in 1949, by location and by months [1]

[Thousands of barrels]

State	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
Arkansas	2,808	2,819	2,799	2,914	2,836	2,558	2,453	2,394	2,194	2,201	2,470	2,537	2,708
California, Washington	33,627	33,117	33,774	33,812	34,661	34,848	34,460	35,714	35,776	36,175	37,287	37,282	38,027
Colorado	782	808	865	834	858	911	846	768	810	814	818	817	815
Georgia, Delaware, Florida, South Carolina, Virginia	461	457	434	475	325	232	224	325	331	360	390	331	327
Illinois, Minnesota, Wisconsin	15,461	15,078	15,149	15,544	15,750	15,669	15,656	14,739	16,235	15,057	14,452	14,597	15,388
Indiana	3,659	3,233	3,545	3,671	3,803	3,854	4,004	3,936	4,173	3,849	3,529	3,440	3,504
Kansas, Nebraska	9,794	9,408	10,365	11,548	16,493	11,345	11,464	10,639	9,533	9,954	10,106	10,242	9,944
Kentucky, Tennessee	1,951	2,230	2,269	2,435	2,710	2,713	2,699	2,592	2,215	2,286	2,326	2,326	2,441
Louisiana, Alabama	13,925	14,084	15,185	14,636	14,669	15,377	14,948	14,369	13,631	11,713	11,826	12,827	13,001
Maryland	1,191	988	1,064	926	1,067	1,055	895	989	973	741	859	629	901
Massachusetts, Rhode Island	1,526	1,261	1,450	1,547	1,631	1,372	1,124	1,018	1,095	778	711	634	574
Michigan	1,551	1,466	1,421	1,646	1,815	1,624	1,742	1,751	1,691	1,569	1,480	1,602	1,515
Mississippi	1,052	998	982	1,069	1,123	973	1,037	1,133	1,024	1,029	943	850	1,037
Missouri, Iowa	5,875	5,864	6,026	6,015	5,876	5,787	5,614	6,135	6,247	5,899	5,987	5,808	5,925
Montana	1,349	1,249	1,069	1,167	1,475	1,553	1,778	1,988	1,884	1,781	1,954	1,940	1,780
New Jersey	6,627	7,525	8,038	8,018	8,051	7,523	6,983	6,425	6,786	7,017	7,206	6,654	7,161
New Mexico	2,192	2,133	2,235	2,187	1,996	2,107	2,333	1,881	1,818	2,071	1,833	2,095	2,054
New York	1,351	1,266	1,350	1,330	1,244	1,317	1,149	1,207	1,046	1,132	1,016	1,198	852
Ohio	7,101	7,218	7,211	8,104	8,430	8,347	8,577	7,580	7,306	7,336	7,129	7,470	7,123
Oklahoma	28,034	28,431	30,121	31,091	27,455	32,593	33,737	32,330	30,860	29,686	27,573	28,635	27,537
Pennsylvania	6,800	7,749	7,736	7,354	7,967	8,163	7,748	8,872	8,061	6,912	7,650	7,417	7,695
Texas	99,350	100,786	101,550	102,633	101,401	102,518	103,985	99,981	96,153	93,025	92,820	96,303	93,049
Utah	679	736	670	614	642	650	641	682	703	541	556	587	581
West Virginia	747	706	718	758	821	781	788	759	710	761	751	715	664
Wyoming, Idaho	8,734	9,038	9,190	9,013	9,421	10,042	9,806	9,379	9,330	9,002	9,137	9,074	8,753
Total	256,627	258,648	265,216	269,341	272,520	273,912	274,691	267,586	260,585	251,689	250,809	256,010	253,356

[1] Preliminary figures.

TABLE 44.—Stocks of crude petroleum in the United States in 1949, by classification and location

[Thousands of barrels]

Classification and location	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
At refineries:													
Arkansas	675	704	710	613	598	374	430	359	368	507	550	577	670
California, Washington	7,329	10,042	10,360	10,409	10,840	10,473	9,731	10,329	10,495	10,450	10,374	10,166	10,551
Colorado	248	242	295	281	289	317	312	240	274	235	292	258	265
Georgia, Delaware, South Carolina	455	451	429	468	318	225	217	320	327	356	384	326	321
Illinois, Minnesota, Wisconsin	3,242	2,991	2,984	3,047	3,275	3,199	3,165	2,826	3,260	3,677	2,912	3,089	3,360
Indiana	1,757	1,618	1,701	1,634	1,533	1,505	1,555	1,434	1,616	1,488	1,442	1,515	1,502
Kansas, Nebraska	2,097	1,927	1,932	2,002	2,387	2,135	1,898	1,608	1,383	1,630	1,679	1,796	1,943
Kentucky, Tennessee	1,016	1,204	1,189	1,282	1,428	1,395	1,368	1,170	759	963	1,053	1,032	1,179
Louisiana	4,532	5,056	5,301	5,227	5,068	5,336	5,069	4,632	4,344	3,300	3,305	3,806	3,510
Maryland	1,191	988	1,064	926	1,067	1,055	895	989	973	741	859	629	901
Massachusetts, Rhode Island	1,526	1,261	1,450	1,547	1,631	1,372	1,124	1,018	1,095	778	711	634	574
Michigan	449	418	356	513	634	497	546	504	428	366	391	410	398
Mississippi	18	33	35	31	30	12	10	11	11	11	9	8	11
Missouri	247	210	218	209	228	200	230	222	230	207	202	203	196
Montana	439	400	347	354	527	634	788	962	923	898	979	1,031	891
New Jersey	6,255	7,169	7,679	7,591	7,574	7,011	6,464	5,919	6,269	6,531	6,725	6,148	6,693
New Mexico	68	51	69	70	56	51	51	43	53	51	63	55	79
New York	1,176	1,074	1,095	1,062	981	1,051	902	974	838	916	824	948	635
Ohio	1,270	1,196	1,160	1,228	1,289	1,223	1,481	1,237	1,212	1,064	1,051	1,179	1,079
Oklahoma	3,079	2,882	2,974	2,878	2,756	2,812	2,723	2,729	2,434	2,276	2,493	2,527	2,665
Pennsylvania	5,099	6,025	5,776	5,310	6,060	6,102	5,593	6,592	5,699	4,988	5,758	5,566	5,831
Texas	16,827	17,156	17,089	17,560	17,457	17,790	17,652	17,097	16,265	15,487	15,208	16,478	15,773
Utah	521	585	535	483	519	526	516	538	573	416	431	461	451
West Virginia	77	59	76	79	90	90	95	46	27	32	27	32	29
Wyoming, Idaho	1,376	1,353	1,493	1,399	1,696	1,414	1,225	994	904	876	931	961	898
Total at refineries	60,969	65,095	66,317	66,203	68,331	66,799	64,040	62,793	60,760	58,244	58,653	59,835	60,405

Pipeline and tank-farm stocks:													
Arkansas	1,753	1,720	1,709	1,921	1,863	1,804	1,648	1,660	1,446	1,324	1,545	1,580	1,663
California	12,097	18,803	19,131	19,073	19,740	20,276	20,716	21,277	21,240	21,642	22,825	23,127	23,404
Colorado	394	421	420	413	409	429	389	398	381	439	376	399	385
Illinois	11,604	11,427	11,535	11,897	11,875	11,850	11,886	11,288	12,370	10,790	10,925	10,918	11,438
Indiana	1,842	1,555	1,784	1,977	2,210	2,289	2,384	2,437	2,492	2,301	2,022	1,865	1,942
Kansas, Nebraska	6,712	6,447	7,468	8,536	13,076	8,115	8,506	7,916	7,050	7,279	7,347	7,406	6,971
Kentucky, Tennessee	875	966	1,020	1,098	1,222	1,258	1,271	1,362	1,396	1,263	1,208	1,224	1,202
Louisiana, Alabama	8,272	7,762	8,608	8,203	8,325	8,680	8,548	8,430	8,116	7,234	7,265	7,779	8,289
Michigan	912	848	865	943	991	932	1,011	1,037	1,053	1,013	894	992	922
Mississippi	604	545	487	623	658	521	587	662	558	593	524	417	621
Missouri, Iowa	5,626	5,652	5,806	5,805	5,646	5,586	5,382	5,911	6,016	5,691	5,785	5,605	5,729
Montana	740	659	532	638	778	739	820	841	781	703	785	729	704
New Jersey	372	356	359	427	477	512	519	506	517	486	481	506	468
New Mexico	1,544	1,492	1,581	1,542	1,335	1,481	1,717	1,248	1,180	1,435	1,195	1,470	1,410
New York	145	162	220	238	228	236	217	198	173	186	157	220	187
Ohio	5,741	5,932	5,956	6,786	7,051	7,044	7,006	6,253	6,004	6,182	5,988	6,201	5,954
Oklahoma	23,775	24,209	25,857	26,993	23,424	28,491	29,784	28,261	27,131	26,145	23,795	24,838	23,662
Pennsylvania	1,541	1,559	1,790	1,884	1,747	1,901	1,995	2,105	2,192	1,769	1,727	1,686	1,704
Texas	77,408	78,173	79,431	80,223	79,134	79,883	81,488	77,969	75,143	72,748	72,692	74,820	72,336
Utah	158	151	135	131	122	122	122	141	126	123	123	123	123
West Virginia	515	492	487	524	576	531	538	558	528	574	564	518	475
Wyoming	6,878	7,165	7,242	7,159	7,265	8,188	8,151	7,925	7,956	7,651	7,761	7,663	7,410
Total pipeline and tank-farm stocks	169,508	176,496	182,423	187,034	188,152	190,868	194,685	188,383	183,849	177,571	175,984	180,086	177,049
Producers' stocks	16,095	17,057	16,476	16,104	16,037	16,245	15,966	16,410	15,976	15,874	16,172	16,089	15,902
Grand total: 1949 [1]	[2] 246,572	258,648	265,216	269,341	272,520	273,912	274,691	267,586	260,585	251,689	250,809	256,010	253,356
1948	224,929	223,430	224,880	227,408	227,278	223,820	223,481	223,124	224,211	228,401	234,615	240,260	246,572

[1] Preliminary figures.
[2] Excludes 10,055,000 barrels of California heavy crude.

PRICES AND VALUE

The average value of crude petroleum at the well, as reported in the annual survey of the Bureau of Mines, rose from \$1.41 per barrel in 1946 to \$1.93 per barrel in 1947 and to \$2.60 per barrel in 1948. The results of the 1949 survey are not yet available, but the average value at the well in 1949 is estimated at \$2.54 per barrel. In the preliminary estimate of the average value per barrel of crude at the well in 1949, consideration has been given to the fact that the decline in the production of lower-priced heavy crudes was relatively much greater than for the lighter crudes.

The average value of crude oil at the well varies considerably with the quality of the oil and the distance from the market. The highest-value crudes are those in the Appalachian district due to their high content of lubricating oils. The value of crude from the Illinois Basin is well above the national average because of quality and nearness to refinery and product markets. The value of crude oils in Oklahoma and Kansas generally closely approximates the national average, good quality being somewhat offset by longer distances to market. The average value of Texas crude approximates the national average but includes a wide range of values due to variations in quality and location.

The main changes in posted prices for crude at the well in 1949 related to further declines for Pennsylvania Grade crudes and general cuts for heavy crudes. The sharp drop in the total demand for lubricants in 1949 affected the former and the decline in the demand for residual fuel oil, accompanied by reduced residual prices and increased imports, resulted in lower prices and a large decline in the demand

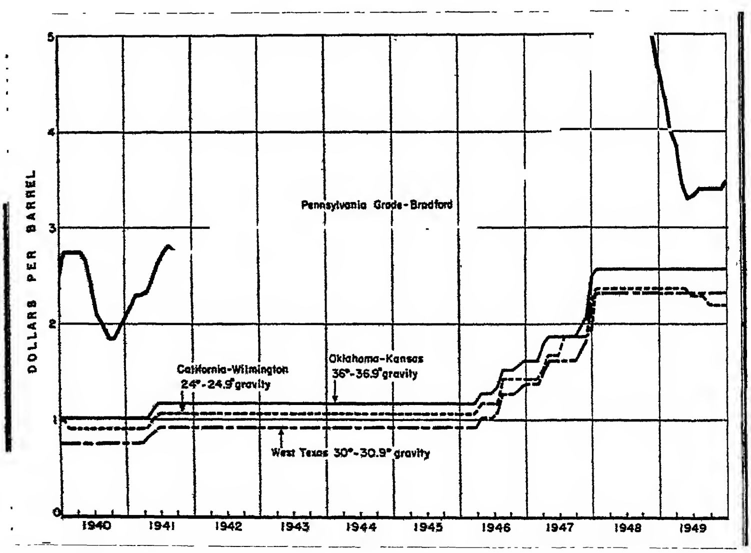

FIGURE 5.—Posted prices of selected grades of crude petroleum in the United States, 1940–49, by months.

for heavy crudes. The rapid decline in the consumption of residual fuel oil by railroads has affected the demand for heavy crudes over a wide area, from Texas to California.

The posted prices for the Bradford and Allegany districts illustrate the trend for Pennsylvania Grade crudes. The posted prices for this district remained at $5 per barrel in 1948 until reduced on December 11, to $4.50 per barrel. Starting at this price on January 1 it was cut to $4 on January 21, reached a low of $3.27 by May 11 and was increased to $3.40 on June 6 and to $3.54 per barrel on December 12.

Reductions shown in the posted prices of representative heavy crudes in 1949 range from 58 cents per barrel for Midway-Sunset crude in California, 25 cents per barrel for Smackover crude in Arkansas, 13 cents for Elk Basin crude in Wyoming, and 10 cents per barrel for Duval-Mirando crude in South Texas. The Independent Petroleum Association of America estimates an average reduction in 1949 for six representative heavy crudes of 22 cents per barrel.

TABLE 45.—Value of crude petroleum at wells in the United States, 1947–48 by States [1]

State	1947		1948	
	Total (thousands of dollars)	Average per barrel	Total (thousands of dollars)	Average per barrel
Arkansas	54,500	$1.82	78,570	$2.48
California	572,990	1.72	822,980	2.42
Colorado	29,680	1.89	45,730	2.56
Illinois	139,560	2.10	179,520	2.77
Indiana	12,800	2.10	19,320	2.77
Kansas	202,900	1.93	288,360	2.60
Kentucky	19,830	2.11	24,380	2.77
Louisiana:				
Gulf Coast	248,650	2.01	371,190	2.69
Northern	72,480	1.99	114,760	2.64
Total Louisiana	321,130	2.01	485,950	2.68
Michigan	34,540	2.13	48,250	2.86
Mississippi	61,470	1.76	110,280	2.41
Montana	16,960	1.94	24,210	2.58
Nebraska	420	1.85	520	2.43
New Mexico	72,440	1.77	117,520	2.45
New York	20,050	4.21	22,830	4.94
Ohio	10,440	3.36	15,190	4.22
Oklahoma	270,760	1.92	398,490	2.58
Pennsylvania	53,170	4.19	62,830	4.96
Texas:				
Gulf Coast	531,580	2.05	754,710	2.75
West Texas	401,230	1.80	676,160	2.46
East Texas proper	231,880	1.98	297,550	2.65
Other districts	432,940	1.96	628,980	2.60
Total Texas	1,597,630	1.95	2,357,400	2.61
West Virginia	10,210	3.90	12,810	4.76
Wyoming	75,220	1.68	128,230	2.33
Alabama, Florida, Missouri, Tennessee, Utah, Virginia	1,190	1.53	1,710	2.00
Grand total	3,577,890	1.93	5,245,080	2.60

[1] Data for 1949 not yet available.

TABLE 46.—Posted price per barrel of petroleum at wells in the United States in 1949, by grades, with dates of change

Date	Pennsylvania Grade: Bradford and Allegany districts [1]	Pennsylvania Grade: In Southwest Pennsylvania pipe-lines [2]	Corning Grade in Buckeye Pipe Line Co.[3]	Western Kentucky [3]	Illinois Basin [4]	Midland, Mich.[5]	Oklahoma-Kansas [6]: 34°-34.9°	Oklahoma-Kansas [6]: 36°-36.9°
Jan. 1	$4.50	$4.10	$3.10	$2.77	$2.77	$2.89	$2.53	$2.57
Jan. 21	4.00	3.60						
Mar. 11	3.75	3.29						
Apr. 1	3.55	3.09						
Apr. 13	3.40	2.94						
May 6			2.70					
May 11	3.27	2.81						
June 16	3.40	2.96						
July 1						2.80		
Dec. 12	3.54	3.11						

Date	Panhandle Texas (Carson, Gray, Hutchinson, and Wheeler Counties), 35°-35.9° [7]	West Texas, 30°-30.9° [7]	Lea County, N. Mex., 30°-30.9° [7]	South Texas, Duval-Mirando, 24°-24.9° [7]	East Texas [7]	Gulf coast: Conroe, Tex.[8]	Gulf coast: Texas, 30°-30.9° [8]	Gulf coast: Texas, 20°-20.9° [8]	Gulf coast: Louisiana, 30°-30.9° [9]
Jan. 1	$2.55	$2.32	$2.32	$2.63	$2.65	$2.83	$2.68	$2.48	$2.55
July 8				2.53					

Date	Rodessa, La., 36°-36.9° [9]	Smackover, Ark. [10]	Elk Basin, Wyo., 30°-30.9° [4]	Salt Creek, Wyo., 36°-36.9° [11]	California [12]: Coalinga, 32°-32.9°	California [12]: Kettleman, 37°-37.9°	California [12]: Midway-Sunset, 19°-19.9°	California [12]: Wilmington, 24°-24.9°
Jan. 1	$2.57	$2.33	$2.27	$2.57	$2.49	$2.64	$2.23	$2.37
Jan. 25							2.11	
Apr. 1							2.06	
Apr. 30		2.08						
May 16			2.14					
June 1					2.58	2.77	1.93	2.29
Sept. 3							1.65	2.20

[1] The Tide Water Associated Oil Co.
[2] The South Penn Oil Co.
[3] Sohio Corp.
[4] The Ohio Oil Co.
[5] The Pure Oil Co.
[6] Standard Oil Co. (Indiana).
[7] Humble Oil & Refining Co.
[8] The Texas Co.
[9] Esso Standard Oil Co.
[10] Arkansas Fuel Oil Co.
[11] Stanolind Oil & Gas Co.
[12] Standard Oil Co. of California.

REFINED PRODUCTS

GENERAL REVIEW

The total demand for all oils averaged 6,120,000 barrels daily in 1949, a decrease of 0.4 percent compared with 1948. This demand was depressed several percent below normal expectations owing to unusually mild weather in the first and last quarters of 1949, a sharp decline in the rate of industrial operations during the middle of the year, large stocks held over by consumers and distributors that decreased new purchases, and by a material decline in total exports. The production of refined products was far below the 1948 level, as shown by a sharp drop in total crude runs to stills. The supply of products was inflated above requirements in 1948 by an increase of almost 80 million

barrels in stocks of refined oils in 1948 compared with a decline of about 1 million in 1949. Furthermore, imports of refined products showed a gain of about 20 million barrels in 1949 compared with 1948.

TABLE 47.—Runs to stills and production at refineries in the United States of the various refined petroleum products, 1945–49

[Thousands of barrels]

Product	1945	1946	1947	1948	1948 [1]	1949 [2]
Input:						
Crude petroleum:						
Domestic	1,645,862	1,645,845	1,754,987	1,907,027	1,924,335	1,790,906
Foreign	73,672	84,352	97,259	124,014	124,014	154,613
Total crude petroleum	1,719,534	1,730,197	1,852,246	2,031,041	2,048,349	1,945,519
Natural gasoline	70,324	62,861	70,692	76,237	76,218	85,457
Total input	1,789,858	1,793,058	1,922,938	2,107,278	2,124,567	2,030,976
Output:						
Gasoline	774,460	748,411	814,841	895,986	895,986	939,051
Kerosine	81,024	104,385	110,412	121,914	121,914	102,152
Distillate fuel oil	249,224	287,896	312,173	380,700	379,340	339,530
Residual fuel oil	469,492	431,364	447,795	466,317	479,988	424,829
Lubricating oil	41,867	45,645	51,765	51,416	51,416	45,389
Wax [3]	2,921	3,003	3,624	3,515	3,515	3,208
Coke [3]	10,115	10,621	12,077	14,494	14,494	16,959
Asphalt [3]	39,196	44,911	49,286	51,919	51,919	49,007
Road oil	2,686	6,175	7,074	7,915	7,916	7,691
Still gas [3]	103,458	88,136	85,564	81,159	81,159	82,621
Liquefied gases	9,292	15,440	18,670	23,676	23,676	23,144
Other finished products	9,788	7,099	5,678	6,929	6,929	5,296
Unfinished gasoline (net)	[4] 4,892	[4] 108	984	[4] 917	[4] 917	[4] 418
Other unfinished oils (net)	[4] 5,727	[4] 1,615	[4] 1,227	[4] 513	4,464	[4] 8,068
Shortage	6,954	1,695	4,222	2,768	2,768	585
Total output	1,789,858	1,793,058	1,922,938	2,107,278	2,124,567	2,030,976

[1] Includes California data on a new basis to compare with 1949.
[2] Preliminary figures.
[3] Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton; 3,600 cubic feet of still gas to the barrel.
[4] Negative quantity; represents net excess of unfinished oils rerun over unfinished oils produced.

The small decline in total demand in 1949, compared with 1948 on a daily average basis, included a gain of about 5 percent for motor fuel and declines of almost 1 percent for residual fuel oil, 6 percent for distillate fuel oil, 9 percent for kerosine, and 6 percent for all other products.

Exports of refined products average 237,000 barrels daily in 1949, a decline of about 12 percent compared with 1948. Exports of motor fuel increased about 6 percent, exports of residual fuel oil and miscellaneous products were about the same, exports of distillate fuel oil were reduced about 43 percent, and kerosine exports dropped about 30 percent.

Domestic demand for all products in continental United States averaged 5,792,000 barrels daily in 1949, a small gain of 0.3 percent compared with 1948—including a gain of about 5 percent for motor fuel and declines of about 1 percent for residual fuel oil, 3 percent for distillate fuel oil, 8 percent for kerosine, and 5 percent for other products.

The new supply of refined products is directly related to the volume of refinery output from crude oil, the production of light products from natural gas, and the imports of refined products.

The production of light products at natural-gasoline and cycle plants increased from 146.7 million barrels in 1948 to 156.2 million in 1949. The amount of motor benzol from coke-oven operations that was blended with motor fuel decreased from 0.4 million barrels in 1948 to 0.2 million in 1949. These two items combined represent the volume of liquid fuels from other sources than crude oil and showed a daily average gain of about 6.5 percent in 1949 compared with 1948. The total amount of these fuels marketed in 1949 amounted to 155.1 million barrels, with about 69 percent included in the motor-fuel balance, over 29 percent included with liquefied petroleum gases for fuel and chemical uses, and less than 2 percent transferred to other products.

Imports of refined products into continental United States increased from 59.1 million barrels in 1948 to 79.2 million in 1949, a gain of almost 35 percent on a daily average basis. The principal change was the increase in imports of residual fuel oil from 53.3 million barrels in 1948 to 74.6 million in 1949, a 40-percent gain. Except for a small gain in unfinished oils, the relatively small imports of other products declined.

TABLE 48.—Salient statistics of the major refined petroleum products in the United States, 1945–49

[Thousands of barrels]

Product	1945	1946	1947	1948	1949 [1]
Motor fuel:					
Production	798,194	776,583	839,998	921,923	961,791
Imports	1,807	1	358	302	
Exports	88,059	45,334	47,449	37,302	39,474
Stocks, end of year	93,682	89,515	87,407	101,060	110,417
Domestic demand	696,333	735,417	795,015	871,270	912,960
Kerosine:					
Production	81,024	104,385	110,412	121,914	102,152
Imports				135	
Exports	6,180	8,637	7,252	3,495	2,532
Stocks, end of year	10,421	17,081	17,722	[2] 23,941	20,888
Domestic demand	75,573	89,088	102,519	112,220	102,673
Distillate fuel oil:					
Production	249,224	287,896	312,173	380,700	339,530
Transfers from crude	3,047	3,123	3,263	3,543	2,701
Imports	4,754	5,204	4,175	2,546	1,720
Exports	33,496	29,487	29,877	21,293	12,189
Stocks, end of year	35,778	59,620	51,081	[2] 71,429	75,207
Domestic demand	226,084	242,894	298,273	340,576	327,984
Residual fuel oil:					
Production	459,492	431,364	447,795	466,317	424,829
Transfers from crude	20,727	23,142	27,091	23,847	4,750
Imports	31,648	44,647	54,244	53,269	74,555
Exports	11,669	9,188	10,623	13,011	12,641
Stocks, end of year	37,158	47,094	47,091	[2] 64,021	60,193
Domestic demand	523,423	480,029	518,510	500,543	495,321

See footnotes at end of table.

TABLE 48.—Salient statistics of the major refined petroleum products in the United States, 1945–49—Continued

[Thousands of barrels]

Product	1945	1946	1947	1948	1949 [1]
Lubricants:					
Production	41,867	45,645	51,765	51,416	45,389
Imports	----------	88	38	101	----------
Exports — Grease	----------	----------	----------	[3] 396	[3] 393
Exports — Oil	6,575	11,051	14,262	12,996	12,612
Stocks, end of year	7,773	7,564	[4] 7,701	9,843	9,219
Domestic demand	35,334	34,891	36,481	35,983	33,008
Wax (1 barrel=280 pounds):					
Production	2,921	3,003	3,624	3,515	3,208
Imports	6	1	4	27	----------
Exports	566	718	1,107	994	1,030
Stocks, end of year	293	308	351	551	473
Domestic demand	2,403	2,271	2,478	2,348	2,256
Coke (5 barrels=1 short ton):					
Production	10,115	10,621	12,077	14,494	16,959
Exports	1,046	1,933	2,102	2,521	2,480
Stocks, end of year	791	450	343	646	698
Domestic demand	9,214	9,029	10,082	11,670	14,427
Asphalt (5.5 barrels=1 short ton):					
Production	39,196	44,911	49,286	51,919	49,007
Imports	809	691	1,159	1,557	1,184
Exports	1,289	2,298	3,262	1,628	1,552
Stocks, end of year	3,810	3,861	[4] 3,771	5,657	4,918
Domestic demand	38,350	43,253	47,023	49,962	49,378
Road oil:					
Production	2,686	6,175	7,074	7,915	7,691
Stocks, end of year	370	606	613	501	366
Domestic demand	2,505	5,939	7,067	8,027	7,826
Still gas: (1 barrel=3,600 cubic feet): Production	103,458	88,136	85,564	81,159	82,621
Other finished products:					
Production:					
LR-gases [5]	9,292	15,440	18,670	23,676	23,144
Other	9,788	7,099	5,678	6,929	5,296
Transfers of LP-gases [6] from natural gasoline	19,978	25,515	35,310	42,991	45,725
Exports	1,105	2,041	2,188	[3] 1,302	[3] 1,498
Stocks, end of year	1,061	1,120	[4] 1,027	1,307	1,262
Domestic demand	37,857	45,954	57,483	72,014	72,712
Unfinished gasoline:					
Rerun (net)	4,892	108	[7] 984	917	418
Stocks, end of year	8,316	8,208	9,192	8,275	7,857
Other unfinished oils:					
Rerun (net)	5,727	1,615	1,227	513	8,068
Transfers of cycle products	848	1,261	1,704	1,914	2,470
Imports	258	978	1,879	1,114	1,750
Stocks, end of year	40,867	41,491	43,847	[2] 61,885	58,037
Shortage	6,954	1,695	4,222	2,768	585

[1] Preliminary figures.

[2] Figure on new basis due to transfers in California of stock formerly reported as distillate and residual fuel oils to "other unfinished oils", and excludes the following quantities from distributors' stocks: Kerosine, 115; distillate fuel oil, 1,469; residual fuel oil, 529. Figures for 1948 on the old basis and comparable with preceding years are as follows: Kerosine, 24,056; distillate fuel oil, 76,001; residual fuel oil, 76,970; other unfinished oils, 46,362.

[3] Beginning with January 1948, exports of grease were transferred from "other finished products" to "lubricants."

[4] Figure on new basis that excludes distributors' stocks in California and is comparable with subsequent years. Figures for 1947 on the old basis and comparable with preceding years are as follows: Lubricants, 8,624; asphalt 4,021; other finished products 1,107.

[5] Liquefied refinery gases.

[6] Liquefied petroleum gases.

[7] Negative quantity; represents net excess of unfinished oils produced over unfinished oils rerun.

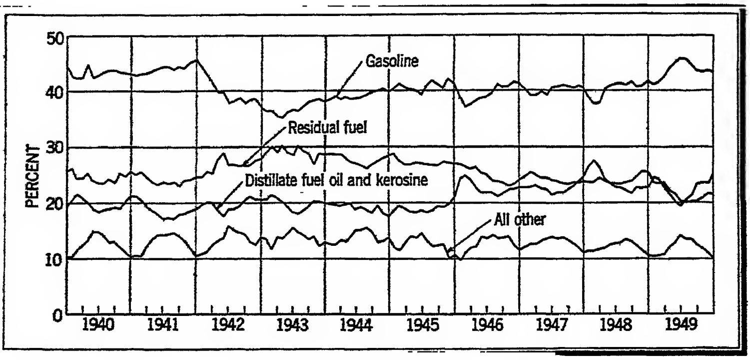

FIGURE 6.—Yields of principal products from crude oil run to stills in the United States, 1940–49, by months.

TABLE 49.—Percentage yields of refined petroleum products in the United States, 1940–49

Product	1940	1941	1942	1943	1944	1945	1946	1947	1948	1948 [1]	1949 [2]
Finished products:											
Gasoline:											
Cracked	22.7	24.4	22.3	22.0	23.2	23.3	22.5	(3)	(3)	(3)	(3)
Straight run	20.4	19.8	17.5	15.1	16.2	17.6	17.1	(3)	(3)	(3)	(3)
Total gasoline	43.1	44.2	39.8	37.1	39.4	40.9	39.6	40.2	40.3	40.1	43.7
Kerosine	5.7	5.2	5.1	5.0	4.7	4.7	6.0	6.0	6.0	6.0	5.2
Distillate fuel oil	14.2	13.4	14.7	14.8	14.4	14.5	16.6	16.8	18.7	18.5	17.4
Residual fuel oil	24.4	24.3	26.9	29.2	27.7	27.3	24.9	24.1	23.0	23.5	21.7
Lubricating oil	2.8	2.8	2.9	2.7	2.5	2.4	2.7	2.8	2.5	2.5	2.3
Wax	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
Coke	.6	.6	.5	.5	.5	.6	.6	.7	.7	.7	.9
Asphalt	2.3	2.6	2.6	2.6	2.3	2.3	2.6	2.7	2.6	2.5	2.5
Road oil	.6	.6	.6	.2	.1	.2	.4	.4	.4	.4	.4
Still gas	5.5	5.9	5.9	6.1	6.1	6.0	5.1	4.6	4.0	4.0	4.2
Other	.3	.4	.6	.7	1.1	1.1	1.3	1.3	1.5	1.5	1.5
Unfinished products:											
Gasoline	.1	.1	.1	(4)	.1	[5].3	(4 5)	(6)	(6)	(6)	(6)
Other	[5].3	[5].2	[5].3	.2	.1	[5].3	[5].1	(7)	(7)	(7)	(7)
Shortage	.6	[5].1	.4	.7	.8	.4	.1	.2	.1	.1	------
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Yields computed on the new basis for California to compare with 1949.
[2] Preliminary figures.
[3] Not separated after 1946.
[4] Less than 0.1 percent.
[5] Negative percentage; represents excess rerun over produced.
[6] Added to finished gasoline production in computing yields after 1946.
[7] Added to crude in computing yields after 1946.

The comparison of refinery operations in 1949 with 1948 is complicated by changes in the method of reporting operations in the California district in the latter year. The major changes involved in 1949 were the reporting of most of the crude oil formerly classed as transfers to residual fuel oil as crude run to stills; compensating adjustments in the refinery output of residual fuel oil, distillate fuel oil, and other unfinished oils; and shifts in the relative stocks of residual fuel and distillate fuel oil, to other unfinished oils. These adjustments were in the supply side and did not change the demand for the major products involved. To obtain correct comparisons for crude runs, refinery production, and yields as reported in 1949, revisions must be made on the same basis for the corresponding items in 1948, while the old 1948 figures are comparable with 1947 and previous years.

The crude runs to stills in 1949 amounted to 1,945.5 million barrels or 5,330,000 barrels daily. The comparable figure for 1948, on the new basis, was 2,048.4 million barrels or 5,597,000 barrels daily—a decline of 4.8 percent in daily average runs.

The yields of the principal refined products from crude oil in 1949 were 43.7 percent for gasoline, 21.7 percent for residual fuel oil, 17.4 percent for distillate fuel oil, and 5.2 percent for kerosine. Comparable yields for 1948, on the new basis, were 40.1 percent for gasoline, 23.5 percent for residual, 18.5 percent for distillate, and 6.0 percent for kerosine.

Total stocks of refined products amounted to 343.5 million barrels on January 1, 1949, and 342.7 million on December 31, 1949—a decrease of 0.8 million during the year, including a decline of 14.3 million in districts east of California and a gain of 13.5 million in the California district.

Stocks of finished gasoline increased 8.1 million barrels in 1949, including gains of 6.1 million in California and 2.0 million east of California. Total stocks of residual fuel oil decreased 3.8 million barrels in 1949, with a gain of 9.3 million in California and a decline of 13.1 million east of California. Total stocks of distillate fuel oil increased 3.8 million barrels in 1949, including gains of 3.7 million in California and 0.1 million in other districts. Stocks of kerosine declined 3.1 million barrels, with an increase of 0.1 million in California and a decline of 3.2 million elsewhere. Stocks of all other products were reduced 5.4 million barrels, including declines of 5.2 million in California and 0.2 million in other districts. These figures indicate a substantial adjustment to excess inventories in districts east of California that was largely offset by surplus production in California.

The small reduction in the value of crude oil at the well in 1949 was not a major factor affecting the price of products. The considerable changes in the prices of the different products were due, in greater part, to surplus seasonal stocks and variations in the demand for the different products.

The average price of Regular Grade gasoline at Oklahoma refineries rose from 8.42 cents per gallon in 1947 to 11.19 cents in 1948 and declined to 10.15 cents per gallon in 1949. The average tank-wagon price of kerosine at Chicago rose from 13.40 cents per gallon in 1947 to 15.85 cents in 1948 and declined to 15.33 cents in 1949. The average price of a selected bright stock at Oklahoma refineries rose from 28.84 cents per gallon in 1947 to 31.67 cents in 1948 and declined to 19.43 cents in 1949. The price of Bunker "C" oil at New York rose from $2.29 per barrel in 1947 to $3 in 1948 and declined to $1.90 in 1949. The price of No. 2 distillate heating oil at New York rose from 7.02 cents per gallon in 1947 to 9.71 cents in 1948 and declined to 8.17 cents in 1949.

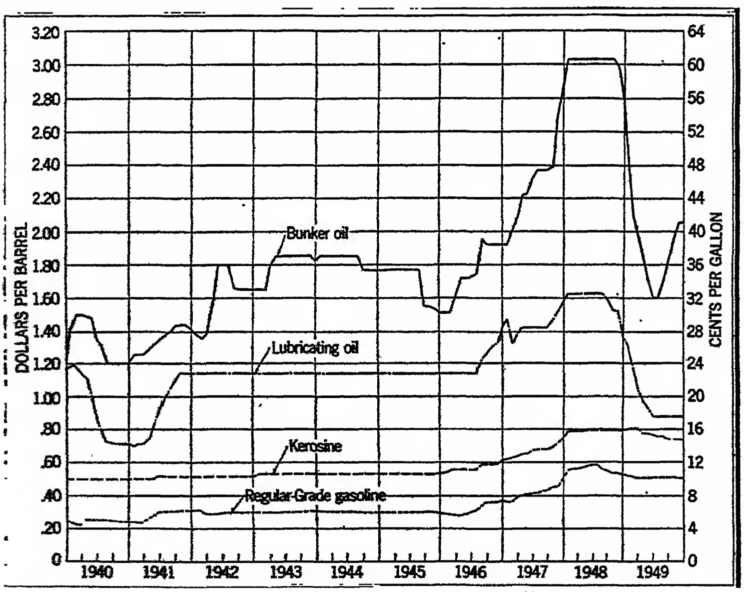

FIGURE 7.—Prices of Bunker "C" oil at New York Harbor, bright stock at Oklahoma refineries, tank-wagon prices of kerosine at Chicago, and Regular Grade gasoline at refineries in Oklahoma, 1940–49, by months.

TABLE 50.—Stocks of refined petroleum products in the United States, 1948–49, by months

[Thousands of barrels]

Product	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
1948												
Gasoline	93,290	102,235	103,398	101,280	99,554	96,221	90,310	87,187	82,254	83,969	87,275	95,481
Kerosine	11,993	10,287	10,464	12,795	15,711	18,480	20,958	23,564	26,177	26,284	25,829	[1] 23,941
Distillate fuel oil	41,036	34,590	32,214	34,514	40,781	48,352	58,725	68,818	76,320	82,920	83,909	[1] 71,429
Residual fuel oil	44,636	43,156	41,945	43,301	48,788	52,465	58,431	64,096	68,005	72,363	77,033	[1] 64,021
Lubricating oil	7,892	7,829	7,961	8,022	8,411	8,166	8,350	8,747	8,884	9,306	9,512	9,843
Wax [1]	374	369	360	389	402	439	487	531	541	552	554	551
Coke [1]	337	396	331	343	417	457	502	553	544	574	583	646
Asphalt [1]	4,468	5,092	5,614	5,956	6,359	5,764	5,267	4,394	3,749	3,768	4,727	5,657
Road oil	644	730	772	1,017	1,067	1,021	879	750	654	520	471	501
Other finished products	1,174	1,231	1,234	1,224	1,397	1,349	1,335	1,334	1,367	1,377	1,443	1,307
Unfinished gasoline	8,877	8,764	8,551	8,549	8,998	8,297	8,529	8,258	8,264	8,457	8,314	8,275
Other unfinished oils	41,888	39,425	39,657	42,338	44,436	45,119	46,755	46,100	47,536	47,286	47,323	[1] 61,885
Total 1948	256,606	254,104	252,501	259,728	276,321	286,130	300,528	314,332	324,295	337,375	346,973	[1] 343,537
1949 [2]												
Gasoline	108,544	117,496	118,822	117,020	113,164	106,068	103,867	97,724	94,445	96,194	97,173	103,586
Kerosine	21,261	18,953	17,801	19,052	21,564	23,648	24,826	25,490	26,650	27,609	25,267	20,888
Distillate fuel oil	61,729	53,937	48,923	51,231	58,381	64,730	71,553	76,037	83,213	90,643	88,212	75,207
Residual fuel oil	62,585	59,398	58,190	59,668	63,576	64,628	66,084	66,843	67,117	68,673	65,112	60,193
Lubricating oil	10,326	10,856	10,931	10,588	10,089	9,922	9,731	8,962	8,734	8,894	9,109	9,219
Wax [1]	542	495	488	481	502	531	530	499	447	465	450	473
Coke [1]	771	790	870	990	1,136	1,142	1,203	1,249	1,180	1,085	802	698
Asphalt [1]	6,733	7,483	7,952	8,305	8,250	7,447	6,859	5,746	4,565	4,391	4,347	4,918
Road oil	484	561	610	827	876	881	776	579	529	441	433	366
Other finished products	1,311	1,328	1,307	1,503	1,515	1,483	1,454	1,393	1,261	1,255	1,239	1,262
Unfinished gasoline	2,394	8,558	8,621	8,331	8,438	7,973	7,350	7,155	7,354	7,093	7,534	7,857
Other unfinished oils	61,003	62,240	63,583	62,910	62,259	64,536	65,002	64,087	64,009	62,170	59,367	58,037
Total 1949	343,683	343,045	338,098	340,906	349,732	352,989	359,235	355,764	359,504	368,913	359,045	342,704

[1] New basis comparable with succeeding years, due to transfers and adjustments in California. Figures for 1948 on old basis and comparable with preceding years: Kerosine—24,056; distillate fuel oil—76,001; residual fuel oil—76,970; other unfinished oils—46,362.

[2] Preliminary figures.

TABLE 51.—Runs to stills and production at refineries in the United States of the various refined products, 1948–49, by months

[Thousands of barrels]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1948													
Input:													
Crude petroleum	165,796	156,014	167,007	166,198	175,705	168,952	174,546	174,242	161,280	173,429	170,166	177,706	2,031,041
Natural gasoline	6,434	5,695	6,187	6,058	6,551	5,979	6,123	6,535	5,962	6,617	6,953	7,143	76,237
Total input	172,230	161,709	173,194	172,256	182,256	174,931	180,669	180,777	167,242	180,046	177,119	184,849	2,107,278
Output:													
Gasoline	72,178	65,659	69,795	71,892	77,052	75,862	77,344	78,499	72,484	77,196	76,541	81,484	895,986
Kerosine	10,697	11,030	11,262	10,236	9,973	9,383	9,442	9,180	9,288	9,663	10,848	10,912	121,914
Distillate fuel oil	38,539	32,688	32,548	29,352	30,764	29,930	30,820	32,190	28,960	33,140	32,434	34,335	380,700
Residual fuel oil	39,606	37,542	40,523	39,104	40,732	38,387	39,177	38,673	34,493	39,313	38,315	40,452	466,317
Lubricating oil	4,287	4,132	4,404	4,308	4,500	4,065	4,135	4,341	4,121	4,580	4,175	4,368	51,416
Wax [1]	350	294	351	332	295	308	267	267	238	263	268	282	3,515
Coke [1]	1,020	1,013	1,209	1,126	1,087	1,281	1,296	1,295	1,228	1,247	1,296	1,396	14,494
Asphalt [1]	3,231	3,035	3,432	3,723	4,501	5,011	5,394	5,842	5,072	5,159	4,211	3,308	51,919
Road oil	230	320	292	506	727	990	1,329	1,336	1,070	532	323	260	7,915
Still gas [1]	6,384	6,004	6,339	6,813	7,330	7,182	7,401	7,418	6,595	6,613	6,577	6,503	81,159
LR-gases	1,876	2,233	2,104	1,881	2,014	1,975	1,836	2,081	1,849	1,805	1,886	2,136	23,676
Other miscellaneous	693	551	591	557	692	570	489	579	455	577	594	581	6,929
Unfinished gasoline (net)	[2] 315	[2] 113	[2] 213	[2] 2	449	[2] 701	232	[2] 271	6	193	[2] 143	[2] 39	[2] 917
Other unfinished oils (net)	[2] 2,323	[2] 2,799	[2] 215	2,363	1,866	519	1,485	[2] 813	1,289	[2] 511	[2] 218	[2] 1,156	[2] 513
Shortage	777	120	772	65	274	169	22	160	94	276	12	27	2,768
Total output	172,230	161,709	173,194	172,256	182,256	174,931	180,669	180,777	167,242	180,046	177,119	184,849	2,107,278

1949 [2]													
Input:													
Crude petroleum	175,295	153,440	165,919	154,223	161,053	154,861	160,358	162,485	162,812	166,568	158,782	169,723	1,945,519
Natural gasoline	6,497	6,314	6,577	6,399	7,241	7,296	7,269	7,319	7,470	8,301	7,449	7,325	85,457
Total input	181,792	159,754	172,496	160,622	168,294	162,157	167,627	169,804	170,282	174,869	166,231	177,048	2,030,976
Output:													
Gasoline	78,807	69,538	76,561	74,831	80,146	77,899	81,009	80,388	78,516	81,927	77,818	81,611	939,051
Kerosine	10,538	8,789	8,974	8,166	7,361	6,715	6,974	7,175	8,093	9,339	9,273	10,755	102,152
Distillate fuel oil	33,016	28,115	28,914	25,368	25,199	23,134	25,870	27,972	30,047	31,024	28,871	32,000	339,530
Residual fuel oil	41,999	35,904	38,996	34,417	35,277	31,218	32,250	33,414	33,299	35,361	35,411	37,283	424,829
Lubricating oil	4,193	3,638	3,698	3,457	3,606	3,804	3,554	3,510	3,729	4,116	3,984	4,100	45,389
Wax [1]	277	220	274	247	259	261	229	238	260	356	257	330	3,208
Coke [1]	1,439	1,263	1,378	1,303	1,614	1,409	1,510	1,520	1,337	1,464	1,401	1,321	16,959
Asphalt [1]	3,060	2,507	2,897	3,581	4,394	4,945	5,137	5,603	5,237	4,964	3,766	2,916	49,007
Road oil	200	245	292	510	772	1,149	1,299	1,521	943	430	253	77	7,691
Still gas [1]	6,524	5,932	6,821	6,962	7,859	7,584	7,555	7,303	6,722	6,758	6,207	6,394	82,621
LR-gases	2,182	2,048	1,814	1,969	1,760	1,785	1,847	1,881	1,928	2,024	1,828	2,078	23,144
Other miscellaneous	591	550	563	546	513	469	442	489	191	261	370	311	5,296
Unfinished gasoline (net)	119	164	63	[3] 290	107	[3] 465	[3] 623	[3] 195	199	[3] 261	441	323	[3] 418
Other unfinished oils (net)	[3] 1,100	1,008	1,015	[3] 951	[3] 827	2,053	271	[3] 1,150	[3] 256	[3] 3,484	[3] 2,556	[3] 2,091	[3] 8,068
Shortage	[4] 53	[4] 167	236	506	254	197	303	135	37	[4] 338	[4] 165	[4] 360	585
Total output	181,792	159,754	172,496	160,622	168,294	162,157	167,627	169,804	170,282	174,869	166,231	177,048	2,030,976

[1] Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton; 3,600 cubic feet of still gas to the barrel.

[2] Preliminary figures.

[3] Negative quantity; represents net excess of unfinished oils rerun over unfinished oils produced.

[4] Negative quantity (overage).

TABLE 52.—Runs to stills and production at refineries in the United States of the various refined petroleum products, 1948–49, by districts

[Thousands of barrels]

	East coast	Appalachian	Indiana, Illinois, Kentucky, etc.	Oklahoma, Kansas, and Missouri	Texas inland	Texas Gulf coast	Louisiana Gulf coast	Arkansas-Louisiana inland	Rocky Mountain	California	Total
1948											
Input:											
Crude petroleum	317,257	57,637	332,233	165,249	89,909	509,587	159,223	29,759	60,002	310,185	2,031,041
Natural gasoline	882	619	8,423	7,524	13,843	18,303	3,188	778	1,016	21,661	76,237
Total input	318,139	58,256	340,656	172,773	103,752	527,890	162,441	30,537	61,018	331,846	2,107,278
Output:											
Gasoline	111,937	25,592	167,136	84,831	55,389	220,423	66,693	11,003	26,768	126,214	895,986
Kerosine	17,004	3,819	21,780	8,916	5,232	37,910	18,409	2,965	1,768	4,111	121,914
Distillate fuel oil	67,377	7,597	49,486	30,760	8,932	115,928	35,489	4,626	10,270	50,235	80,700
Residual fuel oil	84,111	9,652	57,521	27,667	22,203	95,385	27,790	6,764	14,538	120,686	466,317
Lubricating oil	11,163	5,068	5,042	6,131	383	16,129	1,978	1,376	300	3,846	51,416
Wax [1]	1,842	391	278	440	9	463	400		104	88	3,515
Coke [1]	755	317	7,183	1,005	584	1,527	1,249		269	1,605	14,494
Asphalt [1]	14,757	1,676	9,962	5,189	2,521	2,930	3,171	2,980	2,073	6,660	51,919
Road oil	174	7	1,913	511		76	1	16	1,686	3,531	7,915
Still gas [1]	9,491	3,022	15,588	6,489	4,035	22,802	5,734	1,444	2,233	10,321	81,159
LR-gases	3,796	34	2,999	563	77	7,015	5,097	400	51	3,644	23,676
Other miscellaneous	548	296	996	977	1,538	946	87	163	90	1,288	6,929
Unfinished gasoline (net)	[2] 258	24	[2] 138	[2] 58	2,197	[2] 1,972	[2] 104		1	[2] 609	[2] 917
Other unfinished oils (net)	[2] 5,516	272	2,337	1,472	[2] 781	7,386	[2] 1,997	[2] 520	97	[2] 319	[2] 513
Shortage	1,458	489	[3] 1,427	824	1,433	942	[3] 1,586	[3] 680	770	545	2,768
Total output	318,139	58,256	340,656	172,773	103,752	527,890	162,411	30,537	61,018	331,846	2,107,278

1949 [4]											
Input:											
Crude petroleum	280,357	56,551	333,954	155,216	79,281	469,402	157,768	27,417	64,660	320,913	1,945,519
Natural gasoline	1,690	547	9,401	8,071	14,765	19,247	4,654	833	1,350	24,899	85,457
Total input	282,047	57,098	343,355	163,287	94,046	488,649	162,422	28,250	66,010	345,812	2,030,976
Output:											
Gasoline	115,550	27,426	177,685	85,067	53,471	225,776	77,666	11,085	29,797	135,578	939,051
Kerosine	10,446	3,082	19,836	7,217	4,466	31,026	17,380	2,543	1,924	4,232	102,152
Distillate fuel oil	59,375	6,362	48,487	30,056	7,976	86,980	35,857	4,098	11,288	49,101	339,530
Residual fuel oil	68,712	8,686	53,421	23,236	17,167	86,163	19,934	5,815	14,018	127,677	424,829
Lubricating oil	8,645	5,053	4,291	3,823	198	15,128	2,242	1,105	235	4,669	45,389
Wax [1]	1,101	394	248	310	4	553	388	------	75	185	3,208
Coke [1]	1,040	318	8,067	1,406	607	1,624	1,444	------	526	1,927	16,959
Asphalt [1]	12,778	1,859	9,001	4,931	2,618	3,323	2,264	2,818	1,983	7,432	49,007
Road oil	122	2	1,651	660	------	59	4	9	1,637	3,547	7,691
Still gas [1]	10,177	3,364	17,813	5,748	3,759	22,400	5,210	1,037	2,012	11,101	82,621
LR-gases	3,457	48	2,476	746	408	5,486	4,610	362	72	5,479	23,144
Other miscellaneous	336	274	767	528	1,240	723	59	216	23	1,132	5,296
Unfinished gasoline (net)	8	5	347	[2] 183	1,638	[2] 1,597	[2] 126	1	[2] 2	[2] 509	[2] 418
Other unfinished oils (net)	[2] 10,280	[2] 157	2,078	[2] 1,618	[2] 1,725	10,231	[2] 1,432	[2] 600	1,085	[2] 5,650	[2] 8,068
Shortage	580	382	[3] 2,713	1,362	2,219	774	[3] 3,028	[3] 239	1,337	[3] 89	585
Total output	282,047	57,098	343,355	163,287	94,046	488,649	162,422	28,250	66,010	345,812	2,030,976

[1] Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton; 3,600 cubic feet of still gas to the barrel.
[2] Negative quantity; represents net excess of unfinished oils rerun over unfinished oils produced.
[3] Negative quantity (overage).
[4] Preliminary figures.

REFINERY CAPACITY

The total reported daily crude-oil capacity of refineries in the United States increased from 6,438,995 barrels on January 1, 1949, to 6,696,300 at the end of the year—a gain of 257,305 barrels daily during the year. The total capacity in operation declined from 6,230,505 barrels daily on January 1, 1949, to 6,222,998 at the end of the year, while the capacity of all shut-down units increased from 208,490 barrels daily on January 1, 1949, to 473,302 at the end of the year. The total capacity being built, including replacements as well as new capacity, declined from 341,500 barrels daily on January 1, 1949, to 145,600 on January 1, 1950.

The total daily crude capacity of refineries increased about 1,127,000 barrels in the 3 years from January 1, 1947, to January 1, 1950—an increase of about 20 percent. The principal changes in refinery capacity by districts during this period were gains of 328,000 barrels daily in the Texas Gulf coast district, 240,000 in the Indiana-Illinois district, 181,000 in the east coast district, 139,000 in the California district, 112,000 in the Louisiana Gulf coast district, 90,000 in the Oklahoma-Kansas district, 83,000 in the Rocky Mountain district, and 3,000 in the Appalachian district. There were declines of 25,000 barrels daily in the Arkansas and Louisiana inland district, and 24,000 in the Texas inland district.

Assuming that refineries could run annually at about 95 percent of capacity, allowing for necessary shut-downs and repairs, the potential crude runs to stills on January 1, 1950, were 6,361,000 barrels daily, compared with actual crude runs of 5,330,000 barrels daily in 1949, and the all-time peak runs of 5,597,000 barrels daily in 1948, computed on the same basis in California to compare with 1949.

TABLE 53.—Petroleum-refinery capacity in the United States, Jan. 1, 1945–50

Year	Number of refineries				Capacity (barrels per day)			
	Operating	Shut down	Total	Building	Operating	Shut down	Total	Building
1945	380	33	413	1	5,077,690	223,463	5,301,153	36,075
1946	364	29	393	1	5,086,165	229,691	5,315,856	53,100
1947	361	38	399		5,336,399	233,083	5,569,482	162,200
1948	352	38	390	2	5,825,566	208,686	6,034,252	367,250
1949	336	39	375	3	6,230,505	208,490	6,438,995	341,500
1950	320	47	367	2	6,222,998	473,302	6,696,300	145,600

AVIATION GASOLINE

The total demand for aviation gasoline rose from 15.2 million barrels in 1946 to 26.7 million in 1947, 43.0 million in 1948, and 42.8 million in 1949. The lower indicated demand in 1946 and 1947 was due, in considerable part, to liquidation of large stocks held in military custody. Exports of aviation gasoline have steadily increased from 2.3 million barrels in 1946 to 5.1 million in 1947, to 6.2 million in 1948, and to 8.8 million in 1949. Domestic demand for aviation gasoline in continental United States amounted to 12.9 million barrels in 1946, rose to 21.6 million in 1947 and to 36.7 million in 1948, declining to 34.0 million in 1949. This domestic demand included reported deliveries to all military agencies of 1.0 million barrels in 1946, 7.1 million in 1947, 17.6 million in 1948, and 16.8 million in 1949.

The total demand for aviation grades of 100-octane and above has increased rapidly, while the demand for lower finished grades and components has declined. The total demand for 100-octane and above rose from 16.5 million barrels in 1947 to 33.2 million in 1948 and 33.8 million in 1949. The demand for lower grades and components declined from 10.2 million barrels in 1947 to 9.7 million in 1948 and 8.9 million in 1949.

The total production of aviation gasoline by districts indicates that the output of district 3 represented 59.1 percent of the total in 1948 and 59.3 percent in 1949, while the output of district 5 amounted to 26.9 percent of the total in 1948 and 25.3 percent in 1949. The production of district 2 rose from 6.7 percent of the total in 1948 to 9.7 percent in 1949.

Aviation gasoline is discussed separately because of the special interest in this type of fuel. All aviation-gasoline figures are included in the total figures for motor fuel and gasoline in this report. The figures for aviation gasoline represent the amounts so identified and reported by producing companies but do not include the consumption of regular automotive types of gasoline that may be used by many small planes. It should be noted that, in the production figures for aviation gasoline, the item "transfers out" represents rejected material returned to regular grades of gasoline and that this item is subtracted from the gross production figure to determine the net production of marketable grades.

TABLE 54.—Salient statistics of aviation gasoline in the United States in 1948, by months, in thousands of barrels

	January	February	March	April	May	June	July	August	September	October	November	December	1948	1947
Production:														
100-octane and above	2,385	1,825	2,329	2,945	2,775	2,943	2,747	3,190	2,562	2,864	3,143	3,713	33,421	17,867
Other grades	1,058	1,219	986	1,143	1,300	1,172	1,395	1,286	723	739	1,144	660	12,825	17,429
Transfers out	242	270	223	453	301	505	384	374	196	124	96	117	3,285	7,106
Exports	417	203	448	573	725	518	757	343	486	725	424	618	6,237	5,072
Stocks:														
100-octane and above	2,712	2,964	2,808	3,266	2,667	2,614	2,575	2,918	3,172	3,001	3,309	2,603	2,603	2,422
Other grades	3,845	4,222	4,236	4,093	4,123	3,855	3,945	3,728	3,388	3,223	3,488	3,465	3,465	3,642
Domestic demand: All grades	2,291	1,942	2,786	2,747	3,618	3,413	2,950	3,638	2,684	3,090	3,194	4,367	36,720	21,607
Total demand by grades:														
100-octane and above	2,089	1,553	2,480	2,509	3,364	2,988	2,797	2,873	2,304	3,042	2,825	4,382	33,206	16,492
Other finished	605	550	714	788	890	874	858	936	852	754	742	585	9,148	9,188
Components	14	42	40	23	89	69	52	172	14	19	51	18	603	999
Production, by districts:														
100-octane and above:														
District 1	155	114	149	168	117	192	188	274	206	174	216	204	2,247	896
District 2	81	64	81	148	149	212	135	163	191	150	186	112	1,672	891
District 3	1,417	1,051	1,274	1,710	1,327	1,521	1,531	1,632	1,615	1,918	1,913	2,115	19,024	10,476
District 4	26	18	26	22	20	41	14	23	31	36	44	35	342	126
District 5	706	578	799	897	1,156	977	879	1,098	429	586	784	1,247	10,136	5,478
Total	2,385	1,825	2,329	2,945	2,775	2,943	2,747	3,190	2,562	2,864	3,143	3,713	33,421	17,867
Other grades:														
District 1	46	63	69	94	76	54	51	44	7	30	20	59	613	1,545
District 2	54	135	159	197	130	165	134	167	67	98	19	96	1,421	1,819
District 3	701	507	645	494	941	648	815	791	771	587	868	528	8,296	9,747
District 4	20	12	5	27	15	8	31	18	24	14	−3	13	184	276
District 5	237	502	108	331	138	297	364	266	−146	10	240	−36	2,311	4,042
Total	1,058	1,219	986	1,143	1,300	1,172	1,395	1,286	723	739	1,144	660	12,825	17,429

Stocks, by districts:														
100-octane and above:														
District 1	253	325	321	313	305	313	250	291	350	263	315	258	258	225
District 2	221	210	266	306	217	213	229	240	326	308	315	311	311	188
District 3	1,388	1,426	1,293	1,580	1,283	1,374	1,244	1,282	1,500	1,485	1,707	1,438	1,438	1,102
District 4	4	4	10	8	7	7	3	8	6	4	6	8	8	4
District 5	846	999	918	1,059	855	707	849	1,092	990	941	966	588	588	903
Total	2,712	2,964	2,808	3,266	2,667	2,614	2,575	2,913	3,172	3,001	3,309	2,603	2,603	2,422
Other grades:														
District 1	441	474	481	511	540	516	447	387	341	365	343	422	422	412
District 2	395	415	451	551	547	586	598	617	557	562	497	509	509	372
District 3	1,970	1,984	2,029	1,581	1,728	1,551	1,595	1,483	1,548	1,478	1,763	1,801	1,801	1,855
District 4	35	34	26	38	38	27	42	42	51	52	38	41	41	27
District 5	1,004	1,315	1,249	1,412	1,270	1,175	1,263	1,199	891	766	847	692	692	976
Total	3,845	4,222	4.236	4,093	4,123	3,855	3,945	3,728	3,388	3,223	3,488	3,465	3,465	3,642
Total demand, by districts:														
District 1	127	45	173	173	148	171	316	295	246	252	184	228	2,358	1,053
District 2	78	188	139	198	378	310	217	277	217	234	260	198	2,694	2,172
District 3	1,593	1,344	1,865	2,017	2,248	2,057	2,256	2,365	2,004	2,524	2,228	2,821	25,322	16,541
District 4	38	30	33	38	40	60	34	36	48	51	53	43	504	249
District 5	872	538	1,024	894	1,529	1,333	884	1,008	655	754	893	1,695	12,079	6,664
Total	2,708	2,145	3,234	3,320	4,343	3,931	3,707	3,981	3,170	3,815	3,618	4,985	42,957	26,679

TABLE 55.—Salient statistics of aviation gasoline in the United States in 1949,[1] by months, in thousands of barrels

	January	February	March	April	May	June	July	August	September	October	November	December	1949	1948
Production:														
100-octane and above	3,297	2,746	3,078	3,106	3,125	3,039	2,735	2,954	2,805	2,844	2,529	2,957	35,215	33,421
Other grades	860	930	727	869	826	1,093	879	1,082	913	1,111	1,319	1,129	11,738	12,825
Transfers out	38	86	57	168	171	290	262	242	277	385	258	434	2,668	3,285
Exports	1,035	777	986	572	1,038	874	682	805	573	396	736	292	8,766	6,237
Stocks:														
100-octane and above	3,170	3,430	3,123	3,500	3,088	3,144	3,156	2,782	2,817	3,117	2,902	3,338	3,338	[2] 2,504
Other grades	3,620	3,971	3,933	3,857	3,764	3,697	3,428	3,397	3,354	3,489	3,920	4,106	4,106	[2] 3,411
Domestic demand: All grades	2,209	2,202	3,107	2,934	3,247	2,979	2,927	3,394	2,876	2,739	2,638	2,738	33,990	36,720
Total demand by grades:														
100-octane and above	2,633	2,450	3,391	2,726	3,516	2,966	2,722	3,284	2,650	2,418	2,620	2,445	33,821	33,206
Other finished	574	509	694	760	749	865	827	873	769	694	726	560	8,600	9,148
Components	37	20	8	20	20	22	60	42	30	23	28	25	335	603
Production, by districts:														
100-octane and above:														
District 1	294	186	139	150	175	184	203	120	153	182	76	98	1,960	2,247
District 2	136	128	224	270	270	211	206	283	319	381	320	322	3,070	1,672
District 3	1,916	1,868	1,896	1,502	2,005	1,898	1,600	1,660	1,640	1,582	1,648	1,012	21,127	19,024
District 4	23	23	25	25	17	36	16	21	23	3	3	6	221	342
District 5	928	541	794	1,159	658	710	710	870	670	696	482	619	8,837	10,136
Total	3,297	2,746	3,078	3,106	3,125	3,039	2,735	2,954	2,805	2,844	2,529	2,957	35,215	33,421
Other grades:														
District 1	9	43	34	4	23	11	−4	72	34	20	78	39	363	613
District 2	145	184	107	95	146	197	85	146	93	84	42	171	1,495	1,421
District 3	484	359	402	775	317	502	488	721	615	718	642	649	6,672	8,296
District 4	12	11	11	5	20	14	24	8	15	24	16	25	185	184
District 5	210	333	173	−10	320.	369	286	135	156	265	541	245	3,023	2,311
Total	860	930	727	869	826	1,093	879	1,082	913	1,111	1,319	1,129	11,738	12,825

Stocks, by districts:														
100-octane and above:														
District 1	329	377	336	251	289	216	253	227	194	250	241	301	301	258
District 2	342	325	316	349	356	392	385	331	339	384	424	493	394	311
District 3	1,653	1,889	1,624	1,806	1,423	1,659	1,683	1,314	1,433	1,555	1,365	1,490	1,490	1,438
District 4	8	10	9	11	11	8	9	5	7	7	8	9	9	8
District 5	838	829	838	1,083	1,009	869	826	905	844	921	864	1,045	1,045	[2] 489
Total	3,170	3,430	3,123	3,500	3,088	3,144	3,156	2,782	2,817	3,117	2,902	3,338	3,338	[2] 2,504
Other grades:														
District 1	401	426	431	385	360	331	307	299	302	293	366	398	398	422
District 2	611	775	794	748	736	734	622	592	544	512	434	526	526	509
District 3	1,850	1,701	1,624	1,847	1,620	1,439	1,328	1,454	1,508	1,588	1,696	1,806	1,806	1,801
District 4	45	46	48	40	40	34	42	31	33	40	44	59	59	41
District 5	713	1,023	1,036	837	1,008	1,159	1,129	1,021	967	1,056	1,380	1,317	1,317	[2] 638
Total	3,620	3,971	3,933	3,857	3,764	3,697	3,428	3,397	3,354	3,489	3,920	4,106	4,106	[2] 3,411
Total demand, by districts:														
District 1	244	147	188	257	155	277	165	192	204	124	83	19	2,055	2,358
District 2	148	164	321	330	373	307	353	493	444	445	397	325	4,100	2,694
District 3	2,122	2,079	2,635	1,847	2,866	2,250	2,133	2,521	1,922	1,837	2,215	2,148	26,575	25,322
District 4	31	31	35	35	31	57	31	44	33	15	11	15	369	504
District 5	699	558	914	1,037	860	962	927	949	846	714	668	523	9,657	12,070
Total	3,244	2,979	4,093	3,506	4,285	3,853	3,609	4,199	3,449	3,135	3,374	3,030	42,756	42,957

[1] Preliminary figures.
[2] December 31, 1948, stocks—new basis to compare with 1949.

MOTOR FUEL

Motor fuel was the only major product to show a substantial gain in demand in 1949. The total demand for motor fuel set another new record of 952.4 million barrels in 1949—an increase of 43.9 million or 5.1 percent on a daily average basis. Exports increased from 37.3 million barrels in 1948 to 39.5 million in 1949, while domestic demand in continental United States rose from 871.3 million barrels in 1948 to 912.9 million in 1949—a gain of 41.6 million or 5.1 percent on a daily average basis. Since the domestic demand for aviation grades declined from 36.7 million barrels in 1948 to 34.0 million in 1949, the gains were all in automotive and other uses.

TABLE 56.—Salient statistics of motor fuel in the United States in 1948, by months

[Thousands of barrels]

	1948						
	Jan.	Feb.	Mar.	Apr.	May	June	July
Production:							
Refinery gasoline:							
Gasoline	64,329	58,727	62,157	64,331	68,760	68,334	69,751
Naphtha	1,415	1,237	1,451	1,503	1,741	1,549	1,470
Natural gasoline, etc.	12,102	11,442	12,373	11,778	12,149	11,624	11,948
Less sales of LP-gases and transfers of cycle products [1]	4,083	3,914	3,977	3,427	3,254	2,988	3,235
Benzol	50	28	28	28	28	28	28
Total production	73,813	67,520	72,032	74,213	79,424	78,547	79,962
Daily average	2,381	2,328	2,324	2,474	2,562	2,618	2,579
Imports	17		55				
Exports	2,315	1,736	2,610	3,613	3,644	3,377	4,298
Daily average	75	60	84	120	118	113	139
Stocks, end of period:							
Finished gasoline	93,290	102,235	103,398	101,280	99,554	96,221	90,310
Natural gasoline	4,323	4,673	4,806	5,305	5,622	6,077	6,176
Total stocks	97,613	106,908	108,204	106,585	105,176	102,298	96,486
Domestic demand	61,309	56,489	68,181	72,219	77,189	78,048	81,476
Daily average	1,978	1,948	2,199	2,407	2,490	2,602	2,628

	1948—Continued						1947
	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Production:							
Refinery gasoline:							
Gasoline	70,471	65,048	68,881	68,066	72,561	801,416	727,147
Naphtha	1,493	1,474	1,698	1,522	1,780	18,333	17,002
Natural gasoline, etc.	12,235	11,616	12,911	12,990	13,553	146,721	132,173
Less sales of LP-gases and transfers of cycle products [1]	3,516	3,672	4,055	4,185	4,599	44,905	37,014
Benzol	28	28	28	28	28	358	690
Total production	80,711	74,494	79,463	78,421	83,323	921,923	839,998
Daily average	2,604	2,483	2,563	2,614	2,688	2,519	2,301
Imports			194	18	18	302	358
Exports	3,354	3,300	2,875	2,913	3,267	37,302	47,449
Daily average	108	110	93	97	105	102	130
Stocks, end of period:							
Finished gasoline	87,187	82,254	83,969	87,275	95,481	95,481	83,111
Natural gasoline	6,308	6,287	6,173	5,857	5,579	5,579	4,296
Total stocks	93,495	88,541	90,142	93,132	101,060	101,060	87,407
Domestic demand	80,348	76,148	75,181	72,536	72,146	871,270	795,015
Daily average	2,592	2,538	2,425	2,418	2,327	2,381	2,178

[1] Includes LP-gases sold for fuel and chemical uses.

TABLE 57.—Salient statistics of motor fuel in the United States in 1949, by months

[Thousands of barrels]

	1949[1]						
	Jan.	Feb.	Mar.	Apr.	May	June	July
Production:							
Refinery gasoline:							
Gasoline	70,856	62,031	68,548	67,238	71,666	69,394	72,467
Naphtha	1,454	1,193	1,436	1,194	1,239	1,209	1,273
Natural gasoline, etc.	12,987	12,070	12,772	12,335	12,465	11,953	12,468
Less sales of LP-gases and transfers of cycle products [2]	4,529	3,948	3,742	3,621	3,219	3,184	3,266
Benzol	11	11	11	11	11	11	11
Total production	80,779	71,357	79,025	77,157	82,162	79,383	82,953
Daily average	2,606	2,548	2,549	2,572	2,650	2,646	2,676
Imports							
Exports	3,995	3,660	4,204	3,832	4,231	3,528	2,399
Daily average	129	131	136	128	136	118	77
Stocks, end of period:							
Finished gasoline	108,544	117,496	118,822	117,020	113,164	106,068	103,867
Natural gasoline	6,217	7,028	7,405	7,253	7,418	7,031	7,668
Total stocks	114,761	124,524	126,227	124,273	120,582	113,099	111,535
Domestic demand	63,083	57,934	73,118	75,279	81,622	83,338	82,118
Daily average	2,035	2,069	2,359	2,509	2,633	2,778	2,649

	1949—Continued[1]						1948
	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Production:							
Refinery gasoline:							
Gasoline	71,686	69,720	72,258	69,005	72,626	837,495	801,416
Naphtha	1,383	1,326	1,368	1,364	1,660	16,099	18,333
Natural gasoline, etc.	13,043	13,259	13,935	14,235	14,681	156,203	146,721
Less sales of LP-gases and transfers of cycle products [2]	3,891	4,006	4,406	4,901	5,482	48,195	44,905
Benzol	11	11	30	30	30	189	358
Total production	82,232	80,310	83,185	79,733	83,515	961,791	921,923
Daily average	2,653	2,677	2,683	2,658	2,694	2,635	2,519
Imports							302
Exports	4,020	2,613	2,867	2,266	1,859	39,474	37,302
Daily average	130	87	92	76	60	108	102
Stocks, end of period:							
Finished gasoline	97,724	94,445	96,194	97,173	103,586	103,586	95,481
Natural gasoline	7,391	7,607	6,923	7,141	6,831	6,831	5,579
Total stocks	105,115	102,052	103,117	104,314	110,417	110,417	101,060
Domestic demand	84,632	80,760	79,253	76,270	75,553	912,060	871,270
Daily average	2,730	2,692	2,557	2,542	2,437	2,501	2,381

[1] Preliminary figures.
[2] Includes LP-gases sold for fuel and chemical uses.

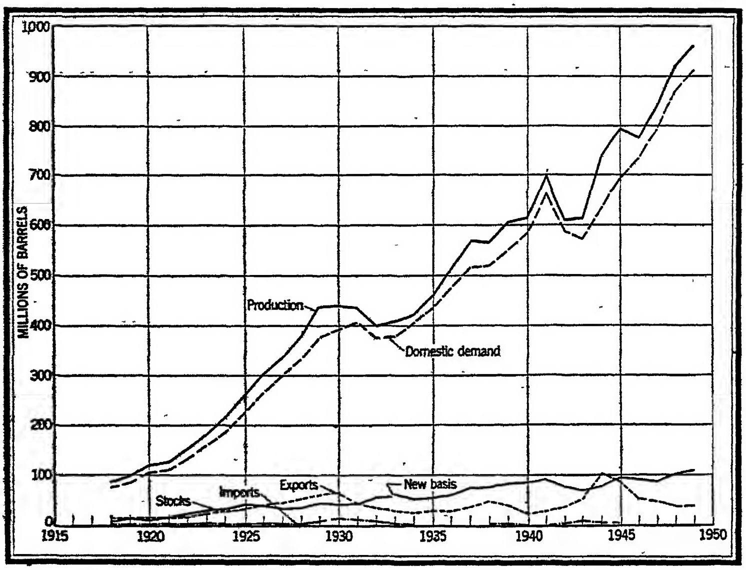

FIGURE 8.—Trends of production, domestic demand, exports, imports, and stocks of motor fuel in the United States, 1918–49.

Production.—The total production of motor fuel rose from 921.9 million barrels in 1948 to 961.8 million in 1949. Production in 1949 included an output of 853.6 million barrels of gasoline and naphtha from crude oil at refineries at a yield of 43.7 percent and an output of motor fuel from other light oils amounting to 108.2 million barrels. The latter figure was obtained by adding the total production of light oils from natural gas to the small amount of motor benzol derived from coke ovens and subtracting the amount of these oils transferred to liquefied gases under miscellaneous products and a relatively small amount of other products transferred to unfinished oils. The total production of these light oils amounted to 156.4 million barrels in 1949 and transfer to products other than motor fuel totaled 48.2 million barrels, leaving the net production included in motor fuel of 108.2 million barrels.

Refinery output of gasoline and naphtha in 1949 totaled 939.1 million barrels, including the output of 853.6 million barrels from crude oil and 85.5 million barrels of the other light oils shipped to refineries for blending.

The remainder of the light oils included in motor-fuel production (22.7 million barrels) was used as motor fuel or blended with gasoline outside refineries, exported, added to storage, or represented losses or shrinkage in processing.

Yields.—The average refinery yield of gasoline and naphtha from crude oil was 43.7 percent in 1949 compared with a yield of 40.1 percent in 1948, computed on the new basis for reporting refinery operations in California. The increase in yield in 1949 reflected the substantial gain in gasoline demand compared to reduced demand and lower production of fuel oils due to surplus inventories.

TABLE 58.—Production of gasoline in the United States in 1949, by districts, and months [1]

[Thousands of barrels]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Gasoline:													
East Coast	9,364	8,570	9,192	9,014	9,631	8,336	9,575	9,629	9,358	9,685	9,358	10,454	112,166
Appalachian	2,425	2,082	2,212	2,117	2,147	2,106	2,275	2,222	2,393	2,251	1,978	2,291	26,499
Indiana, Illinois, Kentucky, etc.	13,823	11,615	13,557	12,659	14,212	13,618	14,258	13,833	14,021	15,248	13,916	14,413	165,173
Oklahoma, Kansas, etc.	6,312	5,558	6,070	5,712	6,232	6,439	6,612	6,737	6,439	6,784	6,368	6,712	75,975
Texas Inland	3,405	2,989	3,186	3,133	3,451	3,451	3,595	3,356	3,034	2,897	2,964	2,941	38,402
Texas Gulf Coast	17,394	15,564	16,723	16,811	17,378	17,171	17,308	16,755	15,928	16,884	16,138	16,591	200,645
Louisiana Gulf Coast	5,281	4,765	5,586	6,232	6,071	6,000	6,040	6,328	6,105	6,291	6,228	6,484	71,411
Arkansas, Louisiana Inland, etc.	834	725	790	763	886	899	892	910	853	885	880	876	10,193
Rocky Mountain	2,330	1,930	2,301	1,914	2,236	2,394	2,495	2,612	2,714	2,327	2,359	2,741	28,353
California and Washington	9,688	8,233	8,931	8,883	9,422	8,980	9,417	9,304	8,875	9,006	8,816	9,123	108,678
Total gasoline	70,856	62,031	68,548	67,238	71,666	69,394	72,467	71,686	69,720	72,258	69,005	72,626	837,495
Naphtha:													
East Coast	146	144	179	143	134	147	118	117	134	197	96	139	1,694
Appalachian	30	29	29	80	44	41	43	46	26	15	25	16	380
Indiana, Illinois, Kentucky, etc.	273	182	223	211	242	288	211	243	243	252	244	449	3,061
Oklahoma, Kansas, etc.	90	102	96	76	82	56	97	89	98	73	98	64	1,021
Texas Inland	22	46	28	17	10	11	9	30	42	37	24	28	304
Texas Gulf Coast	542	440	526	457	524	400	411	476	474	477	579	578	5,884
Louisiana Gulf Coast	146	102	144	101	31	100	159	165	129	167	168	189	1,601
Arkansas, Louisiana Inland, etc.	3	5	3	7	4	10	6	6	7	3	2	3	59
Rocky Mountain	21	6	6	8	3	8	-------	6	13	3	10	10	94
California and Washington	181	137	202	138	165	148	219	205	160	144	118	184	2,001
Total naphtha	1,454	1,193	1,436	1,194	1,239	1,209	1,273	1,383	1,326	1,368	1,364	1,660	16,099
Percent yield of gasoline and naphtha [2]	41.1	41.6	42.5	44.1	45.1	45.9	45.7	44.5	43.7	43.4	43.6	43.4	43.7
Natural gasoline blended at refineries	6,497	6,314	6,577	6,399	7,241	7,296	7,269	7,319	7,470	8,301	7,449	7,325	85,457
Total production:													
East Coast	9,697	8,949	9,468	9,248	9,849	8,577	9,896	9,842	9,594	10,052	9,659	10,719	115,550
Appalachian	2,528	2,158	2,287	2,196	2,225	2,182	2,358	2,307	2,460	2,318	2,046	2,361	27,426
Indiana, Illinois, Kentucky, etc.	14,784	12,503	14,540	13,695	15,309	14,629	15,262	15,085	15,139	16,412	14,774	15,503	177,635
Oklahoma, Kansas, etc.	7,002	6,261	6,763	6,426	7,005	7,083	7,378	7,528	7,249	7,648	7,222	7,502	85,067
Texas Inland	4,390	4,227	4,249	4,305	4,809	4,844	4,848	4,487	4,216	4,531	4,297	4,268	53,471
Texas Gulf Coast	19,472	17,269	18,658	18,496	19,551	19,435	19,313	18,841	18,181	19,169	18,466	18,925	225,776
Louisiana Gulf Coast	5,841	5,182	6,072	6,652	6,465	6,465	6,583	6,906	6,625	6,835	6,867	7,173	77,666
Arkansas, Louisiana Inland, etc.	905	787	863	817	961	983	970	995	928	955	958	963	11,085
Rocky Mountain	2,457	2,004	2,409	2,023	2,389	2,486	2,590	2,729	2,871	2,477	2,495	2,867	29,797
California and Washington	11,731	10,198	11,252	10,973	11,583	11,215	11,811	11,668	11,253	11,530	11,034	11,330	135,578
Total: 1949	78,807	69,538	76,561	74,831	80,146	77,899	81,009	80,388	78,516	81,927	77,818	81,611	939,051
1948	72,178	65,659	69,795	71,892	77,052	75,862	77,344	78,499	72,484	77,196	76,541	81,484	895,986

[1] Preliminary figures.

[2] Based on crude runs to stills adjusted for net unfinished.

Exports.—Exports of motor fuel from continental United States, including shipments to noncontiguous Territories, amounted to 47.5 million barrels in 1947, declined to 37.3 million in 1948, and rose to 39.5 million barrels in 1949. The total in 1948 included 32.6 million barrels exported to foreign countries and 4.7 million shipped to noncontiguous Territories. In 1949 exports to foreign countries amounted to 33.9 million barrels, and shipments to Territories amounted to 5.6 million. The increase of 2.2 million barrels in exports and shipments in 1949 included a gain of 1.3 million to foreign countries and 0.9 million to noncontiguous Territories. Compared with 1948, the largest gains were 1.4 million barrels to North American countries, 0.3 million to Africa, and 0.2 million to Oceania. The principal decline in exports was 0.7 million barrels to Asia. In spite of the increase in 1949, future exports to foreign countries are expected to continue to decline because of the dollar-exchange situation and the increased competition from expanding refinery capacity abroad.

Domestic Demand.—The domestic demand for motor fuel set another new record in 1949, increasing from 871.3 million barrels in 1948 to 912.9 million in 1949. The average domestic demand for motor fuel rose from 2,380,000 barrels daily in 1948 to 2,501,000 barrels daily in 1949, a gain of 5 percent. Domestic demand in the first quarter of 1949 averaged 2,157,000 barrels daily, an increase of 5.5 percent compared with the first quarter of 1948. In the second quarter of 1949, domestic demand averaged 2,640,000 barrels daily or 5.6 percent higher than in the same period of 1948. In the third quarter of 1949, domestic demand averaged 2,690,000 barrels daily or 4.0 percent greater than in 1948. In the fourth quarter of 1949, domestic demand for motor fuel averaged 2,511,000 barrels daily or 5.1 percent above the fourth quarter of 1948. The percentage of total domestic demand, by quarters, in 1949 was 21.3 percent in the first quarter, 26.3 percent in the second quarter, 27.1 percent in the third quarter, and 25.3 percent in the fourth quarter.

The annual survey of the Public Roads Administration includes an analysis of civilian motor-fuel consumption based on tax returns of the various States. The total shown in these surveys is considerably smaller than the domestic demand shown by the Bureau of Mines. The difference represents deliveries to the armed forces, any losses in production or transportation before the point of tax incidence, and probably some commercial and industrial uses of gasoline and naphtha that are not recorded in the exemptions from State taxes. In 1948 this survey covered a total motor-fuel usage of 826.4 million barrels or 44.9 million barrels less than the Bureau of Mines domestic demand of 871.3 million barrels. The total usage for 1948 included 725.3 million barrels for highway use, 92.1 million for nonhighway uses, and 9.0 million for losses. The increase in highway use was 7.7 percent

compared with 1947 on a daily average basis. In 1949 the total usage shown was 877.0 million barrels or 35.9 million less than the Bureau of Mines domestic demand of 912.9 million barrels. The total usage for 1949 included 772.2 million barrels for highway use, 95.4 million for nonhighway uses, and 9.4 million for losses. The increase in highway use was 6.8 percent compared with 1948 on a daily average basis.

Production and Consumption by States.—The accompanying table showing the production and consumption of gasoline by States, is designed to indicate roughly the areas of surplus production and deficit supply. The refinery production used is compiled from reports to the Bureau of Mines and does not include the natural gasoline blended or used outside refineries. The consumption figures used are compiled from State tax reports by the American Petroleum Institute. These figures are closer to the domestic demand figure of the Bureau of Mines than those of the Public Roads Administration, as they include deliveries to the armed forces for use in continental United States but exclude shipments to the armed forces abroad.

In 1949 the refinery production figure amounted to 939.1 million barrels and the consumption figure to 893.9 million barrels. The production figure includes a large part of the gasoline for export and also considerable additions to storage in 1949. The consumption figure of 893.9 million barrels in 1949 was 19.0 million less than the domestic demand figure of 912.9 million barrels shown by the Bureau of Mines.

Comparison of production and consumption by broad districts will indicate the major distribution between surplus and deficit areas. The Gulf Coast States (including Texas, Louisiana, Mississippi, and Alabama) showed a refinery production of 361.4 million barrels of gasoline in 1949 compared with a consumption of 99.0 million—a surplus of 262.4 million. Known movements out of this district include shipments to the Atlantic States of 155.6 million by boat and 15.7 million barrels by pipeline and pipeline shipments of 23.1 million barrels to States to the north. The balance of the surplus includes a major part of total exports and other shipments north by tank car or barge.

The Atlantic Coast States produced 128.6 million barrels of gasoline in 1949 and consumed 284.5 million—a deficit of 155.9 million. Receipts from the Gulf coast of 155.6 by boat and 15.7 by pipeline indicate a surplus that took care of a pipeline movement of 5.5 million barrels to the West and provided for some exports, overseas military shipments, and some rail or barge shipments to the West.

The Pacific coast district (California, Oregon, Washington, Nevada, and Arizona) produced 135.6 million barrels of gasoline in 1949 and consumed 122.6 million. With 6.1 million barrels added to stocks in 1949, the remainder of the surplus represented exports or deliveries outside the district.

TABLE 59.—Production and consumption of gasoline in the United States, 1947–49, by States

[Thousands of barrels]

State	1947		1948		1949 [1]	
	Production	Consumption [2]	Production	Consumption [2]	Production	Consumption [2]
Alabama	(3)	10,409	(3)	11,342	(3)	12,239
Arizona		4,531		4,936		5,059
Arkansas	4,768	7,169	6,026	7,806	6,642	8,445
California	[4] 122,888	81,144	[4] 126,214	86,744	[4] 135,578	89,506
Colorado	2,657	8,855	2,618	9,416	3,423	10,029
Connecticut		10,037		10,528		11,174
Delaware		1,859		1,988		2,177
District of Columbia		3,754		3,992		4,355
Florida		15,539		17,350		18,620
Georgia	[5] 7,461	14,045	[5] 7,984	15,195	[5] 6,294	16,403
Idaho	(6)	3,946	(6)	4,164	(6)	4,372
Illinois	[7] 58,979	43,106	[7] 65,500	46,926	[7] 67,539	49,743
Indiana	46,077	22,996	53,387	25,059	58,314	26,421
Iowa		18,784		20,239		21,312
Kansas	[8] 37,914	15,238	[8] 40,970	16,186	[8] 39,373	16,746
Kentucky	[9] 9,763	10,809	[9] 10,694	11,692	[9] 12,909	12,506
Louisiana	[3] 63,143	9,917	[3] 71,670	10,475	[3] 82,109	11,722
Maine		4,776		4,998		5,150
Maryland	(5)	9,949	(5)	10,572	(5)	11,491
Massachusetts	[10] 3,606	19,543	[10] 3,803	20,619	[10] 2,926	21,937
Michigan	10,632	38,605	11,879	41,034	12,042	42,171
Minnesota	(7)	18,182	(7)	19,604	(7)	20,658
Mississippi	(3)	8,021	(3)	8,594	(3)	9,480
Missouri	(8)	21,358	(8)	23,435	(8)	25,294
Montana	4,042	4,482	4,545	4,860	5,447	5,095
Nebraska	(8)	8,794	(8)	9,562	(8)	10,031
Nevada		1,520		1,558		1,596
New Hampshire		2,697		2,862		2,970
New Jersey	32,555	24,454	34,651	26,393	35,096	28,574
New Mexico	1,845	4,274	2,303	4,663	2,397	4,882
New York	9,446	50,509	8,858	54,359	9,637	58,710
North Carolina		16,689		18,162		19,821
North Dakota		5,664		5,965		6,240
Ohio	34,179	42,259	35,847	46,486	38,862	49,165
Oklahoma	39,667	13,840	43,861	14,637	45,694	15,437
Oregon		10,315		11,258		11,434
Pennsylvania	64,238	43,189	69,446	46,937	74,587	49,287
Rhode Island	(10)	3,516	(10)	3,634	(10)	3,748
South Carolina	(5)	8,315	(5)	9,188	(5)	10,049
South Dakota		5,364		6,074		6,351
Tennessee	(9)	12,534	(9)	13,693	(9)	15,200
Texas	243,934	55,393	275,812	63,447	279,247	65,531
Utah	4,710	3,958	5,170	4,240	6,711	4,445
Vermont		2,033		2,151		2,229
Virginia		14,575		16,105		17,820
Washington	(4)	13,765	(4)	14,738	(4)	15,019
West Virginia	2,206	6,873	2,616	8,070	2,405	8,409
Wisconsin	(7)	19,217	(7)	20,894	(7)	21,850
Wyoming	[6] 10,131	2,550	[6] 12,132	2,876	[6] 11,819	2,970
Total	814,841	779,351	895,986	845,706	939,051	893,873

[1] Preliminary figures.
[2] American Petroleum Institute.
[3] Alabama and Mississippi included with Louisiana.
[4] Washington included with California.
[5] Maryland and South Carolina included with Georgia.
[6] Idaho included with Wyoming.
[7] Minnesota and Wisconsin included with Illinois.
[8] Missouri and Nebraska included with Kansas.
[9] Tennessee included with Kentucky.
[10] Rhode Island included with Massachusetts.

The Mountain States (Montana, Idaho, Wyoming, Colorado, Utah, and New Mexico) produced 29.8 million barrels in 1949 and consumed 31.8 million, indicating a small deficit supplied from the Pacific Coast district or States to the east.

The remaining Central States produced 283.8 million barrels of gasoline in 1949 and consumed 356.0 million—a deficit of 72.2 million. Receipts by pipeline, tank car, and barge from adjacent districts supply this deficit, with the Gulf Coast district the largest contributor. The States in this district east of the Mississippi River produced 192.1 million barrels of gasoline in 1949 and consumed 225.5 million—a deficit of 33.4 million. The States in this district west of the Mississippi produced 91.7 million barrels and consumed 130.5 million—a deficit of 38.8 million.

While by no means complete, the review gives a fair idea of the general domestic distribution of motor fuel and the trends of consumption in different areas.

Methods of Distribution.—The expansion of product pipelines has resulted from the effort to secure a cheaper long-distance movement of products to inland markets. Refineries originally established near oil fields to supply local markets for heavy fuel oils have been forced to seek wider markets for light products. Heavy fuel oil can only be moved by boat or tank car and cannot be profitably moved long distances toward centers of local coal production. The recent decline in the consumption of residual fuel oil by railroads has made this problem more acute. Gasoline is still the major product moved in these lines but increasing amounts of light distillate fuel oils and kerosine are being carried.

In 1948, the product lines delivered 243.2 million barrels of gasoline, 47.8 million barrels of distillate fuel, and 17.7 million barrels of kerosine. Deliveries in 1949 included 278.0 million barrels of gasoline, 49.1 million of distillate, and 17.7 million of kerosine. The increase in gasoline movement was in line with the substantial increase in demand, while the minor changes for the light fuels reflected reduced demand and surplus stocks near the point of consumption.

The major boat movement of products is from the Gulf coast to east coast ports. In 1949 this movement handled 371.8 million barrels of oil products compared with 371.3 million in 1948. Gasoline shipments increased from 145.8 million barrels to 155.6 million; kerosine declined from 40.0 million to 35.0 million; distillate fuel oil declined from 104.6 million to 102.2 million; residual fuel oil fell from 68.7 million to 67.4 million; and lubricants and miscellaneous products decreased from 12.2 million barrels to 11.6 million. The failure of this movement to show a substantial gain reflects reduced fuel-oil demand, large product stocks in the east coast district, and increased imports of residual fuel oil.

TABLE 60.—Movement of petroleum products by pipelines between P. A. W. districts in the United States in 1949, by months

[Thousands of barrels]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
From district 1 to district 2:													
Gasoline	367	319	393	426	393	382	478	553	566	582	481	554	5,494
Kerosine											19		19
Distillate fuel oil													
From district 3 to district 1:													
Gasoline	1,207	1,111	1,375	1,313	1,404	1,413	1,491	1,504	1,257	1,177	1,277	1,119	15,648
Kerosine	378	308	263	169	268	102	134	147	286	324	315	419	3,113
Distillate fuel oil	289	215	260	233	154	205	157	264	220	254	258	287	2,796
From district 3 to district 2:													
Gasoline	1,754	1,183	1,744	1,903	2,064	2,266	1,766	1,650	1,693	1,905	1,784	1,866	21,578
Kerosine	73	72	93	131	54	28	22	31	45	95	81	120	845
Distillate fuel oil	407	439	345	203	270	130	353	382	426	313	323	458	4,049
From district 3 to district 4:													
Gasoline	90	96	115	124	129	139	152	153	157	136	148	120	1,559
Kerosine	14	21	4	9	5	4	3	3	11	17	10	24	125
Distillate fuel oil	5	1	4	5	4	4	6	3	5	5	3	7	52

TABLE 61.—Transportation of petroleum products by pipelines in 1948–49, by months

[Thousands of barrels]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1948													
Turned into lines:[1]													
Motor fuel	17, 124	16, 211	19, 040	20, 725	22, 126	21, 398	22, 087	22, 607	20, 876	22, 185	20, 825	21, 049	246, 253
Kerosine	2, 187	1, 788	1, 681	1, 459	1, 255	919	886	1, 187	1, 164	1, 623	1, 976	1, 955	18, 080
Distillate fuel oil	5, 234	4, 605	3, 997	3, 308	3, 148	3, 730	3, 905	4, 111	3, 427	3, 566	4, 551	5, 037	48, 619
Delivered from lines:[1]													
Motor fuel	16, 276	14, 871	19, 046	20, 698	21, 398	21, 236	22, 533	22, 546	21, 340	22, 306	20, 915	19, 986	243, 151
Kerosine	2, 152	1, 893	1, 780	1, 275	1, 132	859	859	1, 114	1, 129	1, 652	1, 706	2, 104	17, 655
Distillate fuel oil	5, 411	4, 859	4, 276	3, 596	3, 167	3, 014	3, 170	3, 590	3, 296	3, 769	4, 199	5, 409	47, 756
Shortage (or overage):													
Motor fuel	32	34	86	88	63	96	100	86	114	17	58	16	790
Kerosine	49	36	43	25	20	21	6	7	33	21	24	31	316
Distillate fuel oil	20	24	(22)	1	(8)	11	13	27	(8)	26	9	13	106
Stocks in lines and working tanks at end of month:													
Motor fuel	9, 850	11, 156	11, 064	11, 003	11, 668	11, 734	11, 188	11, 163	10, 585	10, 447	10, 299	11, 346	11, 346
Kerosine	720	579	437	596	699	738	759	825	827	777	1, 023	843	843
Distillate fuel oil	1, 951	1, 673	1, 416	1, 127	1, 116	1, 821	2, 543	3, 037	3, 176	2, 947	3, 290	2, 905	2, 905
1949													
Turned into lines:[1]													
Motor fuel	20, 641	18, 184	21, 289	23, 444	25, 218	24, 857	25, 261	25, 765	23, 616	24, 332	24, 282	22, 455	279, 344
Kerosine	2, 241	1, 710	1, 743	1, 279	1, 304	749	1, 007	815	1, 389	1, 495	1, 754	2, 382	17, 868
Distillate fuel oil	5, 524	5, 168	4, 205	3, 079	2, 690	2, 762	3, 254	3, 034	3, 938	4, 170	4, 499	6, 858	49, 181
Delivered from lines:[1]													
Motor fuel	18, 944	17, 383	21, 486	22, 762	25, 477	25, 069	25, 287	26, 121	24, 278	24, 726	23, 832	22, 633	277, 998
Kerosine	2, 042	2, 009	1, 645	1, 264	1, 141	810	994	803	1, 248	1, 596	1, 714	2, 400	17, 666
Distillate fuel oil	5, 656	5, 321	4, 827	3, 436	2, 634	2, 526	2, 724	2, 934	3, 603	3, 998	4, 821	6, 617	49, 097
Shortage (or overage):													
Motor fuel	59	27	48	84	69	76	82	30	93	75	102	16	761
Kerosine	27	35	26	21	29	17	20	26	16	26	34	28	305
Distillate fuel oil	(1)	(2)	5	(4)	3	(7)	5	(1)	11	3	3	2	17
Stocks in lines and working tanks at end of month:													
Motor fuel	12, 984	13, 758	13, 513	14, 111	13, 783	13, 495	13, 387	13, 001	12, 246	11, 777	12, 125	11, 931	11, 931
Kerosine	1, 015	681	753	747	881	803	796	782	907	780	786	740	740
Distillate fuel oil	2, 774	2, 623	1, 996	1, 643	1, 696	1, 939	2, 464	2, 565	2, 889	3, 058	2, 733	2, 972	2, 972

[1] The quantities "Turned into lines" and "Delivered from lines" are on a net basis, eliminating intersystem transfers, and are not comparable with data published for previous years.

Stocks.—Stocks of gasoline, as reported, include stocks held at refineries and bulk terminals and by pipelines but do not include stocks in secondary distribution tanks, in consumers' hands, or in military custody.

Stocks of finished gasoline increased 8.1 million barrels in 1949—from 95.5 million on the first of the year to 103.6 million on December 31, 1949. Stocks of natural gasoline and cycle products increased 1.3 million barrels in 1949—from 5.6 million barrels to 6.8 million on December 31, 1949. Stocks of unfinished gasoline declined from 8.3 million barrels on January 1 to 7.9 million on December 31, 1949—a decrease of 0.4 million.

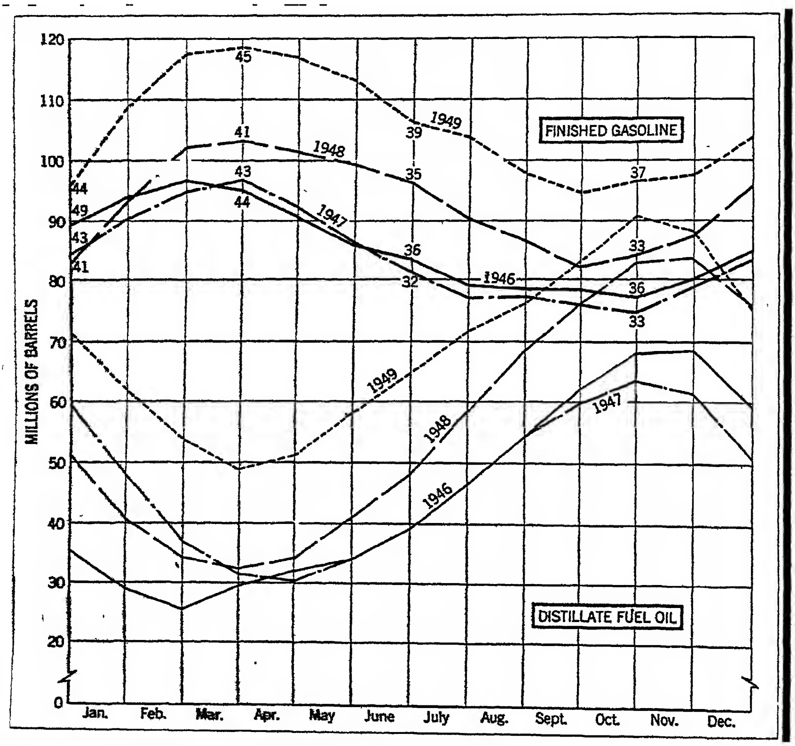

FIGURE 9.—Stocks of finished gasoline in the United States, 1946–49, by months, with figures representing days' supply at certain periods, also stocks of distillate fuel oil, 1946–49, by months.

TABLE 62.—Stocks of gasoline in the United States in 1949, by districts and months

[Thousands of barrels]

District	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
Finished gasoline: [1]												
East Coast	23,900	25,632	26,490	26,825	27,845	25,934	25,406	23,499	22,243	21,980	22,323	22,253
Appalachian	3,664	3,860	3,555	3,544	3,312	3,243	3,322	2,962	3,244	3,564	3,656	3,570
Indiana, Illinois, Kentucky, etc	25,439	27,085	28,148	27,248	26,415	24,280	23,455	21,996	20,944	21,120	20,599	21,882
Oklahoma, Kansas, etc	12,344	13,409	13,508	12,683	11,442	10,805	9,595	8,441	8,361	8,833	9,205	10,592
Texas Inland	4,077	4,645	4,647	4,410	4,301	3,631	3,424	3,277	3,028	3,018	2,927	3,045
Texas Gulf Coast	14,180	15,811	15,791	15,309	13,431	12,295	12,890	12,532	11,792	12,249	12,303	13,475
Louisiana Gulf Coast	6,092	6,271	5,512	5,783	4,812	5,351	5,177	5,219	5,033	5,435	5,304	6,142
Arkansas, Louisiana Inland, etc	2,880	2,958	2,578	2,645	2,499	2,435	2,550	2,590	2,437	2,279	2,510	2,616
Rocky Mountain	3,351	3,734	4,002	3,650	3,556	3,121	2,684	2,244	2,324	2,319	2,516	3,330
California	12,617	14,091	14,591	14,923	15,551	14,973	15,364	14,964	15,039	15,397	15,830	16,681
Total finished gasoline	108,544	117,496	118,822	117,020	113,164	106,068	103,867	97,724	94,445	96,194	97,173	103,586
Unfinished gasoline:												
East Coast	837	837	1,011	946	995	851	758	852	846	777	692	806
Appalachian	378	422	363	363	417	413	395	377	372	375	398	344
Indiana, Illinois, Kentucky, etc	876	1,063	929	908	1,042	898	872	825	752	760	858	915
Oklahoma, Kansas, etc	287	305	401	419	368	338	235	318	260	266	239	234
Texas Inland	534	529	495	447	488	535	349	370	368	503	509	508
Texas Gulf Coast	3,466	3,555	3,471	3,452	3,251	2,978	2,891	2,633	3,017	2,689	3,030	3,262
Louisiana Gulf Coast	412	444	411	331	397	349	423	436	452	394	390	426
Arkansas, Louisiana Inland, etc		4	3	2	1			2	2	1		1
Rocky Mountain	192	190	210	194	188	167	181	166	138	140	139	149
California	1,412	1,209	1,327	1,269	1,291	1,444	1,246	1,176	1,147	1,188	1,279	1,212
Total unfinished gasoline	8,394	8,558	8,621	8,331	8,438	7,973	7,350	7,155	7,354	7,093	7,534	7,857
Total finished and unfinished gasoline:												
East Coast	24,737	26,469	27,501	27,771	28,840	26,785	26,164	24,351	23,089	22,757	23,015	23,059
Appalachian	4,042	4,282	3,918	3,907	3,729	3,656	3,717	3,339	3,616	3,939	4,054	3,914
Indiana, Illinois, Kentucky, etc	26,315	28,148	29,077	28,156	27,457	25,178	24,327	22,821	21,696	21,880	21,457	22,797
Oklahoma, Kansas, etc	12,631	13,714	13,909	13,102	11,810	11,143	9,830	8,759	8,621	9,099	9,444	10,826
Texas Inland	4,611	5,174	5,142	4,857	4,789	4,166	3,773	3,647	3,396	3,521	3,436	3,553
Texas Gulf Coast	17,646	19,366	19,262	18,761	16,682	15,273	15,781	15,165	14,809	14,938	15,333	16,737
Louisiana Gulf Coast	6,504	6,715	5,923	6,114	5,209	5,700	5,600	5,655	5,485	5,829	5,694	6,568
Arkansas, Louisiana Inland, etc	2,880	2,962	2,581	2,647	2,500	2,435	2,550	2,592	2,439	2,280	2,510	2,617
Rocky Mountain	3,543	3,924	4,212	3,844	3,744	3,288	2,865	2,410	2,462	2,459	2,655	3,479
California	14,029	15,300	15,918	16,192	16,842	16,417	16,610	16,140	16,186	16,585	17,109	17,893
Total: 1949	116,938	126,054	127,443	125,351	121,602	114,041	111,217	104,879	101,799	103,287	104,707	111,443
1948	102,167	110,999	111,949	109,829	108,552	104,518	98,839	95,445	90,518	92,426	95,589	103,756

1 Includes stocks of finished gasoline at refineries and bulk terminals, and in pipelines.

The change of finished gasoline stocks by quarters in 1949 indicates a somewhat more than normal gain, or 23.3 million barrels in the first quarter, a decline of 12.8 million in the second quarter, a decrease of 11.6 million in the third quarter, and a substantial gain of 9.1 million barrels in the last quarter.

Stocks of finished and unfinished gasoline increased from 103.8 million barrels on the first of the year to 111.5 million on December 31, 1949—an increase of 7.7 million barrels. The principal changes, by refinery districts, were gains of 5.6 million barrels in the California district, 0.7 million in the mountain district, 0.5 million in the Indiana-Illinois and Texas Gulf districts, and 0.4 million in the Appalachian district. The only declines were 0.3 million barrels in the east coast district and 0.2 million in the Texas inland district.

Stocks may be expressed in terms of days supply by dividing the stocks at the end of a month by the daily average total demand for the succeeding month. Using this basis, the stocks of finished gasoline represented 46.9 days supply in December 1949 compared with 44.1 days supply for December 1948.

TABLE 63.—Days' supply of motor fuel on hand in the United States at end of month, 1947–49 [1]

Month	1947			1948			1949 [2]		
	Finished gasoline	Natural gasoline	Total motor fuel	Finished gasoline	Natural gasoline	Total motor fuel	Finished gasoline	Natural gasoline	Total motor fuel
January	45.5	2.4	47.9	46.5	2.1	48.6	49.4	2.8	52.2
February	45.6	2.4	48.0	44.8	2.0	46.8	47.1	2.8	49.9
March	43.3	2.3	45.6	40.9	1.9	42.8	45.1	2.8	47.9
April	38.6	2.3	40.9	38.8	2.1	40.9	42.3	2.6	44.9
May	34.4	2.2	36.6	36.7	2.1	38.8	39.1	2.5	41.6
June	32.3	2.2	34.5	34.8	2.2	37.0	38.9	2.6	41.5
July	31.4	2.2	33.6	33.4	2.3	35.7	36.3	2.7	39.0
August	31.0	2.0	33.0	32.9	2.4	35.3	35.2	2.6	37.8
September	30.5	1.8	32.3	32.7	2.5	35.2	35.6	2.9	38.5
October	32.9	1.9	34.8	33.4	2.4	35.8	36.7	2.7	39.4
November	34.4	1.9	36.3	35.9	2.4	38.3	38.9	2.9	41.8
December	40.5	2.1	42.6	44.1	2.6	46.7	46.9	3.1	50.0

[1] Stocks divided by the daily average total demand (domestic demand plus exports) for succeeding month.
[2] Preliminary figures.

Prices.—In general, there was a moderate gain in gasoline prices during 1949 compared with substantial declines for other major products. The lighter types of crude most suitable for gasoline production showed few changes in value at the well in 1949, the declines being in crudes high in lubricants or in the heavy types of crude oil.

The average dealer's net price for Regular Grade gasoline (exclusive of tax) in 50 representative cities in the United States supplies an index of gasoline prices at the wholesale level. This average price, according to the American Petroleum Institute, rose from 12.33 cents per gallon in 1947 to 14.55 cents in 1948 and to 15.05 cents in 1949. Starting at 14.66 cents in December 1948, it rose to 14.87 cents in January 1949, 14.92 cents in February, and 15.19 cents in May, and declined to 15.15 cents in September, 15.12 cents in October, and 14.85 cents per gallon in December. In this same series, the average service-station price, including State and local taxes but not the Federal tax,

rose from 24.38 cents per gallon in 1948 to 25.29 cents in 1949. Including the Federal tax of 1.50 cents per gallon, the total average price to the consumer for Regular Grade gasoline rose from 25.88 cents per gallon in 1948 to 26.79 cents in 1949. There was no change in the Federal tax, but the average State taxes rose from 4.61 cents per gallon in 1947 to 4.75 cents in 1948 and 4.92 cents in 1949. The average local taxes rose from 0.07 cent per gallon in 1947 to 0.09 cent in 1948 and 0.10 cent in 1949.

TABLE 64.—Average monthly prices of gasoline in the United States, 1948–49, in cents per gallon

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1948													
Monthly average at refineries in Oklahoma, 73–75 octane [1]	11.13	11.23	11.32	11.39	11.57	11.69	11.65	11.20	11.00	10.75	10.75	10.60	11.19
Average of 50 cities on 1st of month: [2]													
Dealers' net (ex. tax)	14.42	14.49	14.52	14.52	14.52	14.54	14.58	14.59	14.58	14.58	14.58	14.66	14.55
Service station (including State and local taxes only)	24.14	24.21	24.28	24.27	24.31	24.34	24.44	24.47	24.48	24.48	24.49	24.62	24.38
1949													
Monthly average at refineries in Oklahoma, Grades 1 and 2 [1] [3]	10.43	10.27	10.04	10.00	10.00	10.19	10.19	10.19	10.19	10.19	10.07	10.06	------
Average of 50 cities on 1st of month: [2]													
Dealers' net (ex. tax)	14.87	14.92	14.92	14.92	15.19	15.19	15.19	15.19	15.15	15.12	15.12	14.85	15.05
Service station (including State and local taxes only)	24.97	25.01	25.00	25.02	25.31	25.38	25.51	25.55	25.49	25.46	25.47	25.25	25.29

[1] National Petroleum News.
[2] American Petroleum Institute; compiled by the Texas Co.
[3] Grade 1, January–May; Grade 2, June–December 1949.

KEROSINE

The production of kerosine dropped noticeably in 1949; as a result, it was necessary to withdraw an additional quantity from storage to satisfy domestic and export demands. This situation was quite different from conditions prevailing in 1948, when production was not only adequate to satisfy a greatly increased demand but there was also a large surplus diverted to storage. No kerosine was imported in 1949, and only a small amount was received in 1948.

Kerosine production declined from a unusually large total of 121,914,000 barrels in 1948 to 102,152,000 in 1949, a shrinkage of 16 percent. This smaller output in 1949 was due to both a 4-percent drop in crude runs to refineries in 1949 and to a lower yield—5.2 percent compared with 6 percent in 1948.

All refinery districts produced smaller quantities of kerosine in 1949 than in 1948, except the Rocky Mountain and California areas. The greatest relative decline in kerosine production was reported for the East Coast refinery district, where the total of 10,446,000 barrels was 39 percent below the 1948 quantity of 17,004,000 barrels. The 1949 output for the district represented only 10 percent of the na-

tional total compared with a 14-percent proportion in 1948. About 30 percent of the kerosine comes from refineries operating in the Texas Gulf Coast district, and the quantity credited to the area was lower by 18 percent from 37,910,000 barrels in 1948 to 31,026,000 in 1949. The relative decline in kerosine production for the Indiana-Illinois-Kentucky district, where about one-fifth of the total originates, was not so pronounced—only 9 percent—or from a total of 21,780,000 barrels in 1948 to 19,836,000 in 1949. There was also a fairly moderate reduction in the quantity of kerosine produced (down 6 percent) in the Louisiana Gulf Coast district, where the quantities were 18,409,000 barrels in 1948—15 percent of the national total—and 17,380,000 in 1949—17 percent of the output. Refineries in the Oklahoma-Kansas-Missouri group of States turn out about 7 percent of the kerosine, and there the total dropped 19 percent—from 8,916,000 barrels in 1948 to 7,217,000 in 1949.

Relatively less important quantities of kerosine are produced in the remaining refinery districts. The respective totals were lower in 1949 for the Appalachian (down 19 percent), Texas Inland (down 14 percent), and Arkansas-Louisiana Inland-Mississippi areas (down 15 percent) but greater for the Rocky Mountain States, where there was a 9-percent gain in 1949 over 1948, and the California refinery district, where 3 percent more kerosine was produced in 1949.

TABLE 65.—Salient statistics of kerosine in the United States, 1948–49, by months and districts

Month and district	Production (thousand barrels)		Yield (percent)		Domestic demand (thousand barrels)		Stocks, end of period (thousand barrels)	
	1948	1949[1]	1948	1949[1]	1948	1949[1]	1948	1949[1]
By months:								
January	10,697	10,538	6.4	6.0	16,198	12,963	11,993	21,252
February	11,030	8,789	6.9	5.8	12,608	10,593	10,287	18,953
March	11,262	8,874	6.7	5.4	10,881	9,913	10,464	17,801
April	10,236	8,166	6.2	5.2	7,807	6,605	12,795	19,052
May	9,973	7,361	5.7	4.5	6,508	4,577	15,711	21,546
June	9,388	6,715	5.6	4.4	6,351	4,531	18,480	23,648
July	9,442	6,974	5.5	4.4	6,561	5,676	20,958	24,826
August	9,180	7,175	5.2	4.4	6,193	6,315	23,564	25,490
September	9,288	8,093	5.8	5.0	6,376	6,799	26,177	26,650
October	9,663	9,339	5.6	5.5	9,411	8,269	26,283	27,609
November	10,848	9,273	6.4	5.7	10,928	11,454	25,829	25,267
December	10,912	10,755	6.1	6.3	12,399	14,978	[2] 24,056	20,888
Total	121,914	102,152	6.0	5.2	112,220	102,673	24,056	20,888
By districts:								
East Coast	17,004	10,446	5.3	3.6	(3)	(3)	10,330	9,252
Appalachian	3,819	3,082	6.7	5.4			532	448
Indiana-Illinois-Kentucky, etc	21,780	19,836	6.6	6.0			4,801	4,109
Oklahoma, Kansas, etc	8,916	7,217	5.3	4.6			1,227	893
Texas Inland	5,282	4,466	5.8	[illegible]			639	450
Texas Gulf Coast	37,910	31,026	7.5	6.8			3,069	3,061
Louisiana Gulf Coast	18,409	17,380	11.4	10.9			2,392	1,207
Arkansas, Louisiana Inland, etc	2,965	2,548	9.8	9.1			472	345
Rocky Mountain	1,768	1,924	2.9	3.0			279	291
California	4,111	4,282	1.3	1.3			815	832
Total	121,914	102,152	6.0	5.2	112,220	102,673	24,056	20,888

[1] Preliminary figures.
[2] Stocks, 23,941 barrels on new basis to compare with 1949.
[3] Figures not available.

A 9-percent decline in the domestic demand for kerosine in 1949 is in contrast to a 10-percent gain in 1948 over 1947. Domestic requirements in 1949—102,673,000 barrels—were well below the 1948 total of 112,220,000, largely because of milder weather in 1949; furthermore, it is believed that during the unusually cold month of January 1948, when there were spot shortages of light grades of fuel oil, large quantities of kerosine were used for fuel in central heating plants, explaining the greatly expanded demand for that year. The domestic demand for kerosine was down sharply in the first half of 1949—16 percent below in the first quarter compared with the same 3 months of 1948 and 24 percent down in the second quarter. Indicated requirements in the third quarter of 1949 were little below (2 percent) the comparative total for 1948, and there was a 6-percent gain in the final 3 months of the year over the same period of 1948. This rate of increase was accelerated in the opening quarter of 1950, when the domestic demand was 14 percent over the initial 3 months of 1949 and the total (38,258,000 barrels) about equaled the unusually high level reached in the first 3 months of 1948.

With rising difficulties in "dollar" exchange and with more kerosine becoming available from rebuilt and new refineries in foreign countries, American exports have declined sharply from a "peak" of 8,637,000 barrels in 1946 to 3,495,000 in 1948 and 2,532,000 in 1949. The downward trend continued into 1950, as the total for the first quarter is only 583,000 barrels compared with 972,000 in the same period of 1949.

Year-end stocks of kerosine, which reached an unusually high level of 23,941,000 barrels in 1948, declined to 20,888,000 in 1949, a shrinkage of 13 percent. Supplies held at refineries were lower by 15 percent—from 14,110,000 barrels in 1948 to 12,030,000 at the close of 1949—while those at bulk terminals and in pipelines were down by 10 percent—9,831,000 barrels in December 1948 and 8,858,000 a year later. The refinery stocks declined from 59 percent of the total in 1948 to about 58 percent at the end of 1949, and the percentage share held at other points gained correspondingly. Kerosine in storage at the end of 1949 represented a 47-day supply at the January 1950 average daily rate of demand, which compares with a 57-day reserve available 12 months previous.

Stocks of kerosine held in the several refinery districts were lower at the end of 1949 than in 1948, except in the California and Rocky Mountain areas, where quantities stored are relatively of minor importance. About 45 percent of the kerosine inventory is credited to the East Coast area, where the total dropped by 10 percent. About a fifth of the stocks are reported from the Indiana-Illinois-Kentucky refinery district; however, in this group of States the decline in 1949 was well below the average—less than 5 percent for the year. The 1949 year-end total for the Texas Gulf Coast area varied only slightly from the December 1948 quantity, which was in contrast to a 50-percent decline reported for the Louisiana Gulf Coast district. Kerosine stocks carried in other refinery areas are relatively small, and all declined sharply in 1949.

Sales of kerosine continued to mount in 1948 as in recent years, and the total of 112,487,000 barrels reported for the year was about 10 percent over the 1947 quantity of 102,703,000, as reported in the annual survey made by the Bureau of Mines. This gain compares with a 17-percent increase in 1947 over 1946; however, it is believed that the 1948 total was inflated by the use of kerosine in place of No. 1 fuel oil in central heating plants during spot shortages in early 1948 in some areas. This seems to be substantiated by the fact that the indicated demand for kerosine in the first two quarters of 1949 was 24 percent below the comparative total for 1948. Kerosine sold for range oil increased from 62,482,000 barrels in 1947 to 70,629,000 in 1948—a gain of 13 percent compared with an expansion of 20 percent in 1947 over 1946 deliveries. Kerosine reported as delivered for tractor fuel declined sharply from 8,209,000 barrels in 1947 to 6,176,000 in 1948, a drop of 25 percent, due largely to a shift to gasoline for fuel, while all other uses (lamp fuel, insecticides, oil-company uses, etc.) totaled 33,791,000 barrels in 1948, a 6-percent gain over the 1947 demand of 32,012,000 barrels. Distributors reported the delivery of kerosine for jet-propulsion fuel for the first time in 1948—a total of 1,891,000 barrels.

The proportion of kerosine sold to satisfy the range-oil demand continued to rise, rising from 56 percent of the total of all deliveries in 1943 to 61 percent in 1947 and 63 percent in 1948. Kerosine used as tractor fuel accounted for about 6 percent of the market in 1948 compared with an average of 8 percent in recent years. Jet-propulsion fuel reported separately for the first time in 1948 made up less than 2 percent of the kerosine sales, while all other uses declined from 31 percent of all demands in 1947 to 30 percent in 1948.

Over a quarter of the kerosine is sold in the New England States, where it is extensively used for range-burner fuel. Deliveries in that area were 26,293,000 barrels in 1947 and 27,998,000 in 1948—a gain of 7 percent. The Middle Atlantic and North Central States are also important markets for kerosine, and requirements were up by 12 and 8 percent, respectively, in these areas in 1948 compared with 1947. Fairly large quantities of kerosine are also consumed in the South, and deliveries in 1948 were higher by 5 percent in the South Central region and 15 percent in the South Atlantic States. Relatively small amounts of kerosine are distributed in the West Coast and Rocky Mountain areas; however, sales showed substantial gains in 1948.

Most of the kerosine used for tractor fuel is reported from the Middle West. The demand in the North Central States declined from 4,040,000 barrels in 1947 to 3,017,000 in 1948, while quantities for the South Central area were 2,657,000 barrels in 1947 and 1,688,000 in 1948.

TABLE 66.—Sales of kerosine in the United States, 1947–48, by States and uses [1]

[Thousands of barrels]

Region [2] and State	Sold as range oil		Tractor fuel		All other uses		Total	
	1947	1948	1947	1948	1947	1948 [3]	1947	1948
Pacific Coast:								
California	248	493			1,809	2,323	2,057	2,816
Oregon	12	52			173	254	185	306
Washington	18	106			355	331	373	437
Arizona	27	22			181	242	208	264
Nevada	2	3			19	11	21	14
Rocky Mountain:								
Idaho	15	17	2	4	44	15	61	36
Montana	59	62	5	45	85	125	149	232
Wyoming	18	21	19	14	24	187	61	222
Utah	12	17	7	3	16	7	35	27
Colorado	95	105	100	76	77	77	272	258
New Mexico	208	209	44	28	159	152	411	389
North Central:								
North Dakota	168	178	181	132	135	145	484	455
South Dakota	171	201	185	151	127	130	483	482
Minnesota	576	678	240	180	551	546	1,367	1,404
Nebraska	414	453	168	132	254	296	836	881
Iowa	566	734	857	666	898	1,161	2,321	2,561
Wisconsin	428	612	426	342	737	730	1,591	1,684
Illinois	2,522	2,914	541	432	2,212	2,272	5,275	5,618
Indiana	475	539	275	216	1,473	1,895	2,223	2,650
Michigan	871	901	579	388	1,015	1,364	2,465	2,653
Ohio	986	1,116	256	122	736	864	1,978	2,102
Kentucky	233	436	100	62	870	885	1,203	1,383
Tennessee	697	850	232	194	922	975	1,851	2,019
South Central:								
Missouri	711	825	256	66	1,028	1,130	1,995	2,021
Kansas	294	331	370	264	545	552	1,209	1,147
Texas	1,621	1,856	988	557	3,103	3,570	5,712	5,983
Oklahoma	459	616	265	174	915	1,000	1,639	1,790
Arkansas	625	727	270	148	837	843	1,732	1,718
Louisiana	366	441	190	224	922	987	1,478	1,652
Mississippi	300	401	225	160	673	729	1,198	1,290
Alabama	387	480	93	95	803	831	1,283	1,406
New England:								
Maine	2,013	2,465	6	7	96	97	2,115	2,569
New Hampshire	1,305	1,616	2	2	31	33	1,338	1,651
Vermont	731	805	2		80	81	813	886
Massachusetts	13,567	13,955	3	4	560	620	14,130	14,579
Rhode Island	2,862	3,136			85	86	2,947	3,222
Connecticut	4,824	4,954	5	6	121	131	4,950	5,091
Middle Atlantic:								
New York	9,041	10,225	95	132	1,289	1,045	10,425	11,402
New Jersey	4,791	5,704	61	41	1,255	1,365	6,107	7,110
Pennsylvania	2,150	2,435	219	231	1,302	1,429	3,671	4,095
Delaware	274	299	57	21	88	89	419	409
Maryland	1,034	1,286	55	37	690	701	1,779	2,024
District of Columbia	279	293	6	6	141	152	426	451
South Atlantic:								
Virginia	847	1,010	93	67	828	931	1,768	2,008
West Virginia	75	86	4	4	295	281	374	371
North Carolina	1,930	2,264	293	345	969	1,178	3,192	3,787
South Carolina	704	882	73	84	817	1,098	1,594	2,064
Georgia	1,039	1,253	194	176	726	752	1,959	2,181
Florida	1,432	1,565	167	138	941	984	2,540	2,687
Total	62,482	70,629	8,209	6,176	32,012	35,682	102,703	112,487

[1] Figures for 1949 by States not yet available.
[2] States are grouped according to petroleum-marketing territories rather than to conventional geographic

[3] Contains 1,891,000 barrels of jet-propulsion fuel.

TABLE 67.—Sales of range oil in the United States, 1946–48, by States [1]

[Thousands of barrels]

State	1946	1947	1948 Total	1948 Percent of total
Massachusetts	13,296	14,330	14,798	17.6
New York	8,546	9,471	10,732	12.8
New Jersey	4,426	5,073	6,040	7.2
Illinois	3,934	4,906	5,485	6.5
Connecticut	4,442	5,139	5,345	6.4
Rhode Island	2,524	3,027	3,311	3.9
Pennsylvania	1,913	2,501	2,816	3.3
Maine	1,763	2,181	2,674	3.2
North Carolina	1,106	1,969	2,325	2.8
Texas	1,383	1,644	2,025	2.4
Michigan	1,423	1,747	1,881	2.2
Minnesota	1,097	1,455	1,825	2.2
Wisconsin	1,072	1,488	1,762	2.1
New Hampshire	1,028	1,359	1,673	2.0
Florida	1,027	1,508	1,662	2.0
Missouri	1,111	1,368	1,554	1.8
Iowa	852	1,292	1,525	1.8
Ohio	852	1,208	1,385	1.6
Georgia	616	1,136	1,363	1.6
Maryland	815	1,043	1,291	1.5
Virginia	567	903	1,096	1.3
Indiana	707	864	1,082	1.3
South Carolina	478	775	956	1.1
Tennessee	498	753	923	1.1
Arkansas	567	746	872	1.0
Vermont	505	731	805	1.0
Other States	4,016	5,497	6,957	8.3
Total	60,564	74,114	84,163	100.0

[1] Figures for 1949 by States not available when table was compiled.

The survey covering sales of kerosine in 1949 was incomplete when this review was written; however, it is estimated that out of the total indicated demand of 102,673,000 barrels for the year as taken from the Bureau of Mines Monthly Petroleum Statement for December 1949, about 65,700,000 barrels were sold for range oil, 4,800,000 for tractor fuel and the balance—32,173,000 barrels—was delivered for various other uses. It is also believed that an additional 12,300,000 barrels of No. 1 fuel oil were also sold for range burner fuel, making a total range-oil demand of 78,000,000 barrels in 1949.

The upward trend in representative kerosine prices during recent years was interrupted in 1949, when there was a nominal decline. The average price of 9.47 cents a gallon for 41°–43° gravity, water-white kerosine, at refineries in Oklahoma in December 1948 declined gradually to an average of 8.15 cents a gallon in September 1949. With the increased demand in the final quarter of 1949, the quotation was raised slightly to an average of 8.31 cents in December and an average of 8.58 cents for the year compared with the 1948 average price of 9.58 cents a gallon. Kerosine, including No. 1 fuel oil at New York Harbor dropped from an average of 10.57 cents a gallon for December 1948 to a low of 8.45 cents in the June-August period of 1949. It fluctuated up and down in the remaining months of the year to an average of 8.90 cents a gallon in December and an average of 9.12 cents a gallon for the year compared with 10.96 cents for all of 1948.

TABLE 68.—Monthly average prices of kerosine in the United States 1948–49

[Platt's Oil Price Handbook]

Year and grade	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1948													
41°-43° gravity w. w. kerosine at refineries, Oklahoma cents per gallon	9.56	9.56	9.56	9.56	9.56	9.56	9.63	9.63	9.63	9.63	9.60	9.47	9.58
Kerosine (and/or No. 1 fuel oil) at New York Harbor cents per gallon	10.63	11.15	11.15	11.15	11.08	10.95	10.96	10.98	10.98	10.98	10.98	10.57	10.96
Kerosine, tank-wagon at Chicago do	15.60	15.76	15.80	15.80	15.88	15.90	15.90	15.90	15.90	15.90	15.90	15.90	15.85
Kerosine, tank-wagon at New York City do	14.08	14.20	14.20	14.20	14.20	14.20	14.35	14.50	14.50	14.50	14.50	14.31	14.31
1949													
41°-43° gravity w. w. kerosine at refineries, Oklahoma do	9.33	9.24	8.98	8.72	8.69	8.52	8.35	8.16	8.15	8.25	8.25	8.31	8.58
Kerosine (and/or No. 1 fuel oil) at New York Harbor do	10.30	10.30	9.93	9.12	8.61	8.45	8.45	8.45	8.88	9.20	8.83	8.90	9.12
Kerosine, tank-wagon at Chicago do	16.02	16.10	16.07	15.66	15.60	15.43	15.10	15.10	14.85	14.70	14.70	14.71	15.33
Kerosine, tank-wagon at New York City do	14.30	13.99	13.46	12.97	12.45	12.30	12.30	12.30	12.45	12.81	12.90	12.90	12.93

The tank-wagon price of kerosine at Chicago, which averaged 15.90 cents a gallon in December 1948, rose to a 16.10-cent level in February 1949 and gradually declined to a 14.70-cent average in October and November. An increase to 15 cents a gallon on the closing day of the year pulled up the average to 14.71 cents for December and to an average of 15.33 cents for all of 1949 compared with 15.85 cents a gallon in 1948. Kerosine sold from tank wagons in New York City declined gradually from a December 1948 average of 14.31 cents a gallon to 12.30 cents in the June-August period. The quotation then rose to a 12.90-cent average in November and December and a yearly average of 12.93 cents for all of 1949 compared with 14.31 cents in 1948.

Rail and truck shipments of kerosine from the California marketing area to other parts of the country totaled 19,000 barrels in 1949 compared with 25,000 in 1948. No tanker shipments of kerosine from the west coast to the east coast have been made in recent years. The Pacific Coast area received 4,000 barrels of kerosine by overland routes in 1948 and none in 1949.

Published reports released by the Oil and Gas Division, United States Department of the Interior, show that barge shipments of kerosine to terminals on the Mississippi River and its tributaries totaled 5,783,000 barrels in 1949 compared with 5,342,000 in 1948. Texas was credited with 912,000 barrels of the total in 1949 and 507,000 in 1948; Louisiana 3,634,000 barrels in 1949 and 3,678,000 in 1948; and Arkansas and Mississippi 1,237,000 barrels in 1949 compared with 1,157,000 in 1948. Most of these river shipments are terminated in district 2 (5,270,000 barrels in 1949 and 4,826,000 in 1948); however, relatively smaller quantities are also credited to district 3—513,000 barrels in 1949 and 516,000 in 1948. No kerosine reached district 1 over this inland water route in 1948 or 1949.

Tankers and barges moved 35,045,000 barrels of kerosine from the Gulf to the east coast in 1949 compared with a total of 40,020,000 in 1948. Suppliers in Texas were credited with 24,862,000 barrels of the total in 1949 and 31,024,000 in 1948, while the balance, 10,183,000 barrels in 1949 and 8,996,000 in 1948, originated in Louisiana.

There were numerous changes in the Gulf coast—east coast tanker rates for kerosine and other petroleum products in both 1948 and 1949. The rate for kerosine in this movement charged by vessels of over 14,000 tons deadweight, which was $2.565 a long ton or 32.3 cents a barrel on December 31, 1948, was raised to 36.1 cents on January 5, 1949. Frequent changes thereafter brought the rate down to 15.1 cents a barrel on August 10. There was an upward trend in the freight rate after that date until the charge reached 36.1 cents—the same as the early January rate—on December 21, 1949. The average tanker rate for kerosine carried on this run was 25.6 cents a barrel for all of 1949 compared with 47.9 cents in 1948.

DISTILLATE FUEL OIL

Although the total supply of distillate fuel oil, including Diesel fuel, from production, imports, and transfers from crude petroleum in 1949 was about 11 percent below the quantity available in 1948, it was sufficient to satisfy a slightly lower domestic demand and greatly re-

TABLE 69.—Salient statistics of distillate fuel oil in the United States, 1948–49, by months and districts

[Thousands of barrels]

Month and district	Production		Yield (percent)		Transfers[1] East of California		Transfers[1] California		Imports		Exports		Domestic demand		Stocks, end of period	
	1948	1949[2]	1948	1949[2]	1948	1949[2]	1948	1949[2]	1948	1949[2]	1948	1949[2]	1948	1949[2]	1948	1949[2]
By months:																
January	33,539	33,016	19.9	18.7	298	283			107	116	1,739	1,546	42,250	41,569	41,036	61,729
February	32,688	28,115	20.6	18.5	269	238			585		1,241	1,246	38,747	34,899	34,590	53,937
March	32,548	28,914	19.5	17.5	300	245			322	2	1,767	1,685	33,779	32,490	32,214	48,923
April	29,352	25,368	17.9	16.3	289	254			71		1,907	1,165	25,505	22,149	34,514	51,231
May	30,764	25,199	17.7	15.6	302	217			466	175	2,355	866	22,910	17,575	40,781	58,381
June	29,930	23,134	17.8	15.1	276	206	107		412	382	2,258	869	20,896	16,504	48,352	64,730
July	30,820	25,870	17.8	16.2	278	218			66	219	2,468	694	18,323	18,790	58,725	71,553
August	32,190	27,972	18.4	17.1	277	209			3	195	2,167	1,034	20,210	22,858	68,818	76,037
September	28,960	30,047	18.0	18.4	276	194				245	1,291	832	20,443	22,478	76,320	83,213
October	33,140	31,024	19.0	18.3	276	214	19		270	179	1,493	846	25,612	23,141	82,920	90,643
November	32,434	28,871	19.0	18.0	289	200	14		233	145	1,336	875	30,645	30,772	83,909	88,212
December	34,835	32,000	19.2	18.6	273	223			11	62	1,271	531	41,256	44,759	[3]76,001	75,207
Total	380,700	339,530	18.7	17.4	3,403	2,701	140		2,546	1,720	21,293	12,189	340,576	327,984	76,001	75,207
By districts:																
East Coast	67,877	59,375	20.9	20.4											23,158	23,780
Appalachian	7,597	6,362	13.2	11.2											1,185	1,012
Indiana, Illinois, Kentucky, etc.	49,486	48,437	15.0	14.6	563	426									11,395	10,511
Oklahoma, Kansas, etc.	30,760	30,056	18.5	19.2	660	495									5,279	5,360
Texas Inland	8,932	7,976	9.8	9.8	1,217	1,032			(4)	(4)	(4)	(4)	(4)	(4)	854	899
Texas Gulf Coast	115,928	86,980	23.1	18.9	502	376									13,636	14,369
Louisiana Gulf Coast	35,489	35,857	22.0	22.5	192	130									4,159	4,178
Arkansas, Louisiana Inland, etc.	4,626	4,098	15.3	14.6	44	34									811	560
Rocky Mountain	10,270	11,288	17.1	17.9	225	208									1,675	1,557
California	50,235	49,101	16.2	15.0			140								13,849	12,981
Total	380,700	339,530	18.7	17.4	3,403	2,701	140		2,546	1,720	21,293	12,189	340,576	327,984	76,001	75,207

[1] Figures represent crude oil used as fuel on pipe lines.
[2] Preliminary figures.
[3] Stocks—71,429,000 barrels on new basis to compare with 1949.
[4] Figures not available.

duced exports plus a small amount to add to stocks. In comparison, an unusually high production of light fuel oils in 1948 enabled suppliers to meet a greatly expanded domestic demand and large exports and in addition there was a surplus of about 25 million barrels to add to storage. The indicated domestic demand for distillate-grade fuel oils in 1949—327,984,000 barrels—was down slightly (about 4 percent) from the 1948 requirements—340,576,000 barrels—while exports were lower by nearly a half—12,189,000 barrels in 1949 compared with 21,293,000 in 1948.

Gains in the domestic demand for distillate fuel oils in the final quarters of 1949 over 1948 requirements were not sufficient to compensate for losses in the first two quarters; consequently, the yearly total was lower by a net 4 percent. The domestic demand in the first quarter of 1949 (108,958,000 barrels) was 5 percent below the unusually high level —114,776,000 barrels—reached in the corresponding period of 1948, and the total for the April–June quarter of 1949—56,228,000 barrels—was much lower (19 percent) than the comparative total—69,311,000 barrels—reported in 1948. This downward trend in domestic demand was reversed in the second half of 1949, when third-quarter requirements—64,126,000 barrels—were about 9 percent over the 1948 total of 58,976,000, and the October–December demand of 98,672,000 barrels was slightly above the 97,513,000 required in the similar period of 1948. A sharp upward trend in the domestic market for light fuel oils was evident in the first quarter of 1950, when the total of 125,494,000 barrels for the period was 15 percent above the 1949 item of 108,958,000 and also somewhat over the former record volume of 114,776,000 reported for the initial quarter of 1948, when a very cold January forced up the demand for heating oils.

The 1949 survey made by the Bureau of Mines, covering sales of fuel oils, is incomplete at the time this review is written; however, an estimate of the principal demands for distillate grades of fuel oil, as based on available information from various independent sources, is as follows, with quantities in barrels: Railroads, 38,700,000; vessels, 13,400,000; gas and electric power plants, 13,800,000; smelters, mines, and manufacturing plants, 27,500,000; heating oils, 190,500,000; No. 1 fuel oil sold as range oil, 12,300,000; military uses, 7,500,000; oil-company uses, 2,800,000; and miscellaneous uses, 21,500,000.

TABLE 70.—Sales of distillate fuel oil[1] in the United States, 1944–48, by uses[2]

[Thousands of barrels]

Use	1944	1945	1946	1947	1948
Railroads	10,627	14,458	17,570	23,619	31,006
Ships' bunkers (including tankers)	13,187	14,130	12,064	14,475	14,511
Gas and electric power plants	5,837	6,824	10,581	14,216	14,856
Smelters, mines, and manufacturing industries	16,953	19,071	21,317	24,489	29,932
Heating oils	111,729	121,342	139,637	178,359	200,624
Fuel oil (No. 1) sold as range oil	6,619	7,481	8,459	11,632	13,534
U. S. Navy, Army, and Coast Guard	42,879	30,366	9,385	5,176	7,237
Oil-company fuel	981	1,128	1,890	2,191	3,625
Miscellaneous uses	15,060	16,825	18,647	23,857	25,414
Total United States	[3] 223,872	[3] 231,625	239,550	298,014	340,139
Exports and shipments to noncontiguous Territories	43,491	33,496	29,487	29,877	21,293
Total	267,363	265,121	269,037	327,891	361,432

[1] Includes Diesel fuel.
[2] Figures for 1949 not available when table was compiled.
[3] These totals involve some duplication owing to rehandling of fuel oil initially sold to the Government.

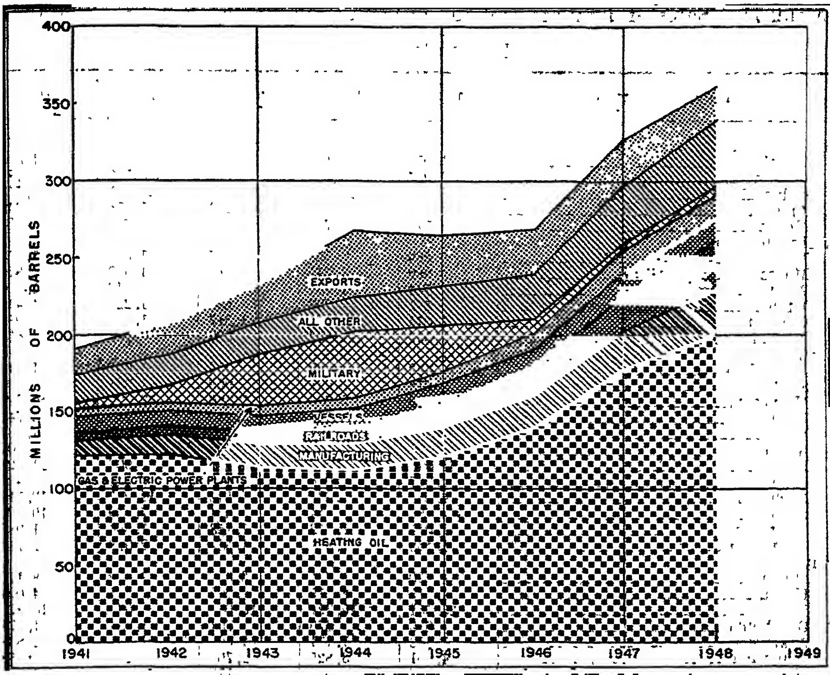

FIGURE 10.—Sales of distillate fuel oil, including Diesel oil and range oil, in the United States, 1941–48, by uses.

Reported sales of distillate fuel oils rose from 298,014,000 barrels in 1947 to 340,139,000 in 1948—a gain of 14 percent. Virtually all uses showed large gains. Railroads bought 31 percent more light fuel oils, mostly Diesel grade, in 1948, and the total for smelters, mines and manufacturing industries was a fifth over 1947 requirements. Oil companies used 65 percent more light fuel oil in their field, pipeline, and refinery operations in 1948 than in 1947, and sales to military forces were larger by 40 percent. The demands for heating oils and for No. 1 oil for range burner fuel were also up substantially—12 and 16 percent, respectively. Gas and electric power utilities brought only 5 percent more of distillate fuel oils in 1948 than in 1947, and the quantity credited to vessels was virtually the same for both years.

Consumers in all parts of the country bought more distillate fuel oil in 1948 than in 1947. About a third of all sales was reported from the Middle Atlantic States, and the demand there was greater by 13 percent in 1948. Over a quarter of the market is in the North Central region, and sales in the area in 1948 were 14 percent above 1947 requirements. Oil companies operating in the Pacific coast area sold 13 percent of the distillate fuel oil in 1948 and the volume was 12 percent over the 1947 total. Deliveries in New England (about 12 percent of the total) were greater by 10 percent in 1948, and the gain in the South Central States (10 percent of all sales) was 24 percent over the 1947 total. Only relatively small amounts of

TABLE 71.—Sales of distillate fuel oil [1] in the United States, 1944–48, by States [2]

[Thousands of barrels]

Region [3] and State	1944	1945	1946	1947	1948
Pacific Coast:					
Washington	5,933	6,586	7,695	9,602	11,005
Oregon	2,927	3,219	4,592	5,720	6,181
California	18,032	16,753	17,840	20,481	22,573
Arizona	878	961	1,126	1,173	1,342
Nevada	715	715	766	951	1,363
Rocky Mountain:					
Idaho	569	597	787	1,034	1,570
Montana	989	1,745	1,381	1,660	1,810
Wyoming	744	1,231	537	643	1,600
Utah	571	703	839	1,223	1.448
Colorado	1,015	1,171	1,517	1,724	1,976
New Mexico	522	563	570	708	653
North Central:					
North Dakota	482	662	916	1,067	1,312
South Dakota	618	691	909	1,338	1,434
Minnesota	5,290	5,658	7,120	9,327	10,229
Nebraska	2,561	2,578	2,716	3,340	3,744
Iowa	3,528	4,633	5,149	6,099	7,435
Wisconsin	4,986	5,074	6,106	8,203	8,609
Illinois	16,056	17,174	16,635	20.906	21,622
Indiana	2,927	3,086	3,830	6,153	8,429
Michigan	6,535	7,337	8,542	12,277	13,713
Ohio	3,586	4,414	5,054	7,479	10,120
Kentucky	1,067	1,172	1,158	1,586	1,980
Tennessee	1,168	1,331	1,559	2,018	2,143
South Central:					
Missouri	4,900	5,364	6,362	7,072	8,110
Kansas	1,615	2,115	2,282	2,881	4,094
Texas	23,551	19,724	10,686	8,035	10,120
Oklahoma	662	676	701	1,084	1,571
Arkansas	1,152	1,134	1,363	1,733	1,838
Louisiana	4,961	3,825	2,762	3,274	4;268
Mississippi	627	631	777	912	1,002
Alabama	1,375	1,255	1,473	1,937	2,493
New England:					
Maine	1,012	1,149	1,440	2,266	2,435
New Hampshire	820	879	1,001	1,387	1,455
Vermont	575	626	699	816	875
Massachusetts	10,460	11,640	12,865	19,290	20,612
Rhode Island	2,440	3,049	3,097	3,389	3,403
Connecticut	5,789	6,210	6,784	8,635	10,487
Middle Atlantic:					
New York	27,770	29,954	33,376	38,888	45,332
New Jersey	25,535	25,964	22,201	26,011	28,755
Pennsylvania	12,925	12,618	14,781	19,916	22,198
Delaware	803	512	570	783	866
Maryland	4,026	4,976	5,271	7,551	8,442
District of Columbia	1,786	1,863	2,039	2,733	2,789
South Atlantic:					
Virginia	3,535	2,612	3,146	4,539	4,875
West Virginia	314	338	374	475	585
North Carolina	1,252	1,584	2,177	2,552	3,220
South Carolina	924	917	1,144	1,427	1,597
Georgia	959	1,298	1,564	1,956	2,593
Florida	2,495	2,658	3,271	3,760	3,833
Total	[4] 223,872	[4] 231,625	239,550	298,014	340,139

[1] Includes Diesel fuel oil.
[2] Figures for 1949 not available when table was compiled.
[3] States are grouped according to petroleum-marketing territories rather than to conventional geographic regions.
[4] These totals involve some duplication owing to rehandling of fuel oil initially sold to the Government

light fuel oils are sold in the South Atlantic and Rocky Mountain regions; however the quantities for these areas were up 14 and 30 percent, respectively, in 1948 over 1947 totals.

Exports and shipments of distillate fuel oil to noncontiguous territories have dropped from a wartime "peak" of 43,491,000 barrels in 1944 to 21,293,000 in 1948 and 12,189,000 in 1949. This decline in United States exports in recent years was to be expected as supplies of fuel oil from foreign sources approached peacetime levels. Im-

portant quantities credited to various countries have changed as follows: Canada, 5,488,000 barrels in 1948 and 2,746,000 in 1949; United Kingdom, 4,934,000 in 1948 and 2,314,000 in 1949; Sweden, 853,000 in 1948 and 675,000 in 1949; and Denmark, 464,000 in 1948 and 587,000 barrels in 1949. Shipments of 1,060,000 barrels of distillate fuel oil to the Netherlands Antilles in 1948, believed to be for cracking into other products, were not repeated in 1949.

Refining companies produced 380,700,000 barrels of distillate fuel oils in 1948 (yield 18.7 percent) and 339,530,000 in 1949, representing a yield of 17.4 percent. The quantities and yields for the 2 years are not comparable, as the production and percentage yields in 1948 were based only on the crude petroleum processed at refineries, while in 1949 both crude and rerun material were taken into account. A table of salient statistics for distillate fuel oil included in this review shows the production and yields by months and refinery districts for both 1948 and 1949.

Pipeline companies use some light crude oil as fuel in operating their lines. These quantities are entered into the distillate fuel-oil account as "transfers" and represent about 1 percent of the total supply. "Transfers" dropped from 3,543,000 barrels in 1948 to 2,701,000 in 1949—a 24-percent shrinkage. The larger share of the "transfers" was made in the Texas inland refinery district, and there the total declined from 1,217,000 barrels in 1948 to 1,032,000 in 1949. Relatively important quantities were also credited to the Indiana-Illinois-Kentucky district (563,000 barrels in 1948 and 426,000 in 1949); Oklahoma-Kansas-Missouri district (660,000 barrels in 1948 and 495,000 in 1949); and Texas Gulf coast district—502,000 barrels in 1948 and 376,000 in 1949. No light crude oil was transferred to the distillate fuel-oil supply in the east coast, Appalachian, and California refinery districts in 1949.

Imports of distillate fuel oils declined by a third from 2,546,000 barrels in 1948 to 1,720,000 in 1949, and the respective quantities represented less than 1 percent of the total supply in both years. Over half of the 1949 total originated in Trinidad, Netherlands Antilles, Venezuela, and Colombia, while virtually all the balance came from the Near East or Saudi Arabia and Bahrein.

Stocks of distillate fuel oil—75,207,000 barrels—held at the end of 1949 were on a new basis and therefore are not comparable with those on hand at the close of 1948. Certain changes in the reporting of stocks of both crude and refined products were made in the California refinery district beginning in January 1949 in order to put them on a more comparable basis with those held east of California. The principal changes for the California area were (1) discontinuance of the separation between "gasoline bearing" and "heavy" crude stocks; (2) shift of cracking stock from the distillate and residual fuel oil inventory to "other unfinished" oils; and (3) elimination from bulk terminal stocks of certain quantities of refined products held in distributors' tanks. Furthermore, additional information about stocks in other refinery districts also made some revision necessary.

Tanker shipments of distillate fuel oil from California to the east coast rose from 161,000 barrels in 1947 to 1,177,000 in 1948. This

unusual increase, which was due to a temporary shortage in certain eastern areas in the early months of 1948, was not repeated in 1949, when the total for the year declined to 66,000 barrels. Rail and truck shipments of distillate fuel oil from the California refinery district to other Western States declined from 1,250,000 barrels in 1948 to 849,000 in 1949, while receipts in the west coast marketing area from other States increased from 333,000 barrels in 1948 to 1,413,000 in 1949.

The quantity of distillate fuel oil shipped by tanker and barge from the Gulf coast to ports along the Atlantic coast declined slightly from 104,609,000 barrels in 1948 to 102,147,000 in 1949, according to records compiled by the Oil and Gas Division, United States Department of the Interior. Texas was credited with 85,190,000 barrels of the above totals in 1948 and 80,748,000 in 1949, while the balance—19,419,000 barrels in 1948 and 21,399,000 in 1949—came from Louisiana. Fairly important quantities of distillate fuel oil are also shipped from the Gulf area up the Mississippi River and its tributaries to markets in districts 1, 2, and 3. Official records show that the volume of these shipments declined from 5,031,000 barrels in 1948 to 4,796,000 in 1949. Texas supplied 716,000 barrels of this demand in 1948 and 1,209,000 in 1949, and Louisiana 4,200,000 barrels in 1948 and 2,961,000 in 1949, while the remaining 115,000 barrels in 1948 and 626,000 in 1949 originated in Mississippi and Arkansas. District 1 received 119,000 barrels of these distillate fuel oil shipments in 1948 and 69,000 in 1949; district 2, 4,444,000 barrels in 1948 and 4,421,000 in 1949; and district 3, 468,000 barrels in 1948 and 306,000 in 1949.

Tanker rates for No. 2 distillate fuel oil shipped from the Gulf to the New York area were changed frequently in both 1948 and 1949. The freight charge for this grade of fuel oil carried in this traffic was $2.565 a long ton or 34 cents a barrel as of December 31, 1948. The quotation was advanced to 37.8 cents a barrel on January 5, 1949, and then there was a steady downward trend to 16 cents a barrel as of August 10. The rate netted upward during the summer and fall months of 1949 and finally ended at 37.8 cents a barrel on December 21, the same as it had been at the beginning of the year. The weighted average tanker rate for 1949 on distillate fuel oil carried in this movement was 27.3 cents a barrel compared with 50 cents a barrel in 1948.

Prices of distillate fuel oils, which showed some leveling off in 1948, continued downward in 1949. The market quotation for No. 2 Straw fuel oil at refineries in Oklahoma declined from an average of 8.87 cents a gallon in December 1948 to 7.25 cents for July 1949. There was a slight "mark-up" as the fall and winter demand influenced the market until the price reached an average of 7.63 cents for the closing month of the year. The weightd average for all of 1949 was 7.73 cents a gallon for this grade compared with 9.67 cents in 1948. The New York Harbor price for No. 2 fuel oil followed a similar pattern, declining from an average of 9.24 cents a gallon in December 1948 to 7.5 cents in June and July 1949. It then turned upward to 8.59 cents in October; however, subsequent changes brought it down to 8.3 cents a gallon in November and 8.4 cents in December 1949. The year's weighted average was 9.71 cents a gallon for 1948 and 8.17 cents for 1949.

TABLE 72.—Monthly average prices of distillate fuel oil and Diesel fuel in the United States, 1948–49

[Platt's Oil Price Handbook]

Year and grade	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1948													
No. 2 Straw fuel oil at refineries, Oklahoma cents per gallon	10.53	10.63	11.08	9.86	9.50	9.50	9.50	9.23	9.13	9.13	9.11	8.87	9.67
No. 2 fuel oil at New York Harbor do	9.47	9.68	10.15	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.71	9.24	9.71
Diesel oil, shore plants, New York Harbor do	9.72	9.75	9.75	9.75	9.75	9.75	9.75	9.85	9.85	9.85	9.85	9.65	9.77
Diesel oil for ships:													
New York dollars per barrel	3.94	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.02	4.02	4.00
New Orleans do	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.64	3.64
San Pedro do	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.23	3.32	3.20
1949													
No. 2 Straw fuel oil at refineries, Oklahoma cents per gallon	8.71	8.53	8.11	7.76	7.50	7.40	7.25	7.30	7.42	7.56	7.56	7.63	7.73
No. 2 fuel oil at New York Harbor do	9.10	8.90	8.38	7.83	7.49	7.50	7.50	7.72	8.39	8.59	8.30	8.40	8.17
Diesel, oil, shore plants, New York Harbor do	9.55	9.55	9.33	8.67	8.37	7.90	7.90	8.11	8.79	9.00	9.00	9.00	8.76
Diesel oil for ships:													
New York dollars per barrel	4.00	4.00	3.79	3.56	3.40	3.40	3.40	3.46	3.64	3.70	3.70	3.70	3.65
New Orleans do	3.63	3.63	3.54	3.27	3.11	3.11	3.11	3.17	3.32	3.35	3.35	3.35	3.33
San Pedro do	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35

Most of the light Diesel fuels averaged lower in 1949 than in 1948. Diesel oil at shore plants around New York Harbor was quoted at 9.65 cents a gallon in December 1948. The price declined to 7.9 cents a gallon in the middle of 1949 and then rose to 9 cents in the final quarter. The average for all of 1949 was 8.76 cents a gallon compared with 9.77 cents in 1948. Diesel oil for ships at the port of New York was priced at $4.02 a barrel in December 1948, and subsequent reductions brought the quotation down to $3.40 a barrel during the midyear 1949. This value was followed by an increase to $3.70 a barrel for the final quarter and a $3.65 average for all of 1949 compared with $4 in 1948. The price of Diesel fuel for ships' bunkers at New Orleans followed a similar trend, which resulted in a average of $3.33 a barrel for 1949 against $3.64 in 1948. Diesel fuel for vessels loading at San Pedro, Calif., was raised to $3.35 a barrel on December 14, 1948, and that quotation remained unchanged throughout 1949, which made the price somewhat above the weighted average of $3.20 a barrel in 1948.

Retail prices of fuel oils for a number of cities are published monthly by the Bureau of Labor Statistics, United States Department of Labor. The price of No. 2 fuel oil at New York averaged 12.71 cents a gallon in December 1948 and 12.74 cents in January 1949. There was a subsequent downward trend to 10.20 cents a gallon in August, and following this the price advanced with minor interruptions to an average of 12.02 cents in December 1949. The quotation for No. 2 distillate fuel oil at Chicago was 13.57 cents a gallon at the end of 1948 and then a slight advance to 13.67 cents held during the first quarter of 1949. The summer price went down to 11.53 cents a gallon, but this was raised to 11.93 cents in the closing months of 1949.

RESIDUAL FUEL OIL

Due to some major changes in accounting methods, the salient statistics for residual fuel oil in 1948 and 1949 are not on a comparable basis. The production, imports, and transfers from crude were not quite adequate to satisfy the export and domestic demands in 1949; consequently, a small amount (less than 1 percent of all requirements) was withdrawn from storage to make up the definciency. Production, imports, and transfers of residual fuel oil in 1948 were not only adequate for all market demands, but there was in addition a large surplus, which was diverted to stocks.

A review of the domestic demand for residual fuel oil by quarters in 1949 shows losses in the first two quarters compared with 1948 and gains in the closing periods, which changes are just the reverse of what happened in 1948, when there was a rising market in the first half of the year compared with 1947, followed by declines in the final quarters. It should be added that the quarterly demand totals for 1949 were all below comparative quarterly requirements of 2 years previous or for 1947.

The domestic demand for residual grades of fuel oil of 135,352,000 barrels in the first quarter of 1949 was about 5 percent below the corresponding total of 141,894,000 indicated for the same period of 1948, and the decline was even more pronounced (11 percent) in the second

TABLE 73.—Salient statistics of residual fuel oil in the United States, 1948–49, by months and districts

[Thousands of barrels]

Month and district	Production		Yield (percent)		Transfers [1]				Imports		Exports		Domestic demand		Stocks, end of period	
					East of California		California									
	1948	1949 [2]	1948	1949 [2]	1948	1949 [2]	1948	1949 [2]	1948	1949 [2]	1948	1949 [2]	1948	1949 [2]	1948	1949 [2]
By months:																
January	39,606	41,999	23.6	23.8	435	300	1,704	278	5,093	5,131	614	1,047	48,679	48,097	44,636	62,585
February	37,542	35,904	23.6	23.5	386	265	1,401	226	5,452	4,296	798	967	45,463	42,911	43,156	59,398
March	40,523	38,996	24.3	23.7	407	293	1,227	104	5,205	4,939	821	1,196	47,752	44,344	41,945	58,190
April	39,104	34,417	23.9	22.2	379	282	1,315	114	4,686	5,621	1,337	871	42,791	38,085	43,301	59,668
May	40,732	35,277	23.4	21.8	382	285	1,387	178	3,734	4,860	1,031	1,314	39,717	35,378	48,788	63,576
June	38,387	31,218	22.8	20.4	398	221	1,474	142	3,574	5,385	1,169	1,037	38,987	34,877	52,465	64,628
July	39,177	32,250	22.6	20.1	371	235	1,829	139	4,123	5,705	1,279	1,191	38,255	35,682	58,431	66,084
August	38,673	33,414	22.1	20.4	435	250	1,963	202	4,478	5,985	1,459	811	38,425	38,281	64,096	66,843
September	34,493	33,299	21.6	20.4	375	215	962	62	4,332	7,081	1,227	745	35,028	39,639	68,005	67,117
October	39,313	35,361	22.6	20.9	351	239	1,723	98	3,106	8,181	1,328	1,193	38,807	41,130	72,363	68,673
November	38,315	35,411	22.5	21.8	314	209	1,938	84	4,112	7,316	901	1,046	39,108	45,535	77,033	65,112
December	40,452	37,283	22.6	21.7	331	239	2,360	89	5,374	10,055	1,047	1,223	47,533	51,362	[3]76,970	60,193
Total	466,317	424,829	23.0	21.7	4,564	3,033	19,283	1,717	53,269	74,555	13,011	12,641	500,543	495,321	76,970	60,193
By districts:																
East Coast	84,111	68,712	26.1	23.6											11,917	10,777
Appalachian	9,652	8,686	16.8	15.3											713	456
Indiana-Illinois-Kentucky, etc	57,521	53,421	17.4	16.1	528	594									5,465	3,625
Oklahoma, Kansas, etc	27,667	23,236	16.6	14.8	362	258									2,956	1,314
Texas Inland	22,203	17,167	24.5	21.2	1,432	648			[4]	[4]	[4]	[4]	[4]	[4]	1,250	856
Texas Gulf Coast	95,385	86,163	19.0	18.8	290	250									11,792	6,249
Louisiana Gulf Coast	27,790	19,934	17.2	12.5	839	728									3,816	2,139
Arkansas, Louisiana Inland, etc	6,764	5,815	22.3	20.8	550	352									327	228
Rocky Mountain	14,538	14,018	24.1	22.2	563	203									1,138	558
California	120,686	127,677	38.9	39.1			19,283	1,717							37,596	33,991
Total	466,317	424,829	23.0	21.7	4,564	3,033	19,283	1,717	53,269	74,555	13,011	12,641	500,543	495,321	76,970	60,193

[1] Represents quantities used on leases and for general industrial purposes.
[2] Preliminary figures.
[3] Stocks—64,021,000 barrels on new basis to compare with 1949.
[4] Figures not available.

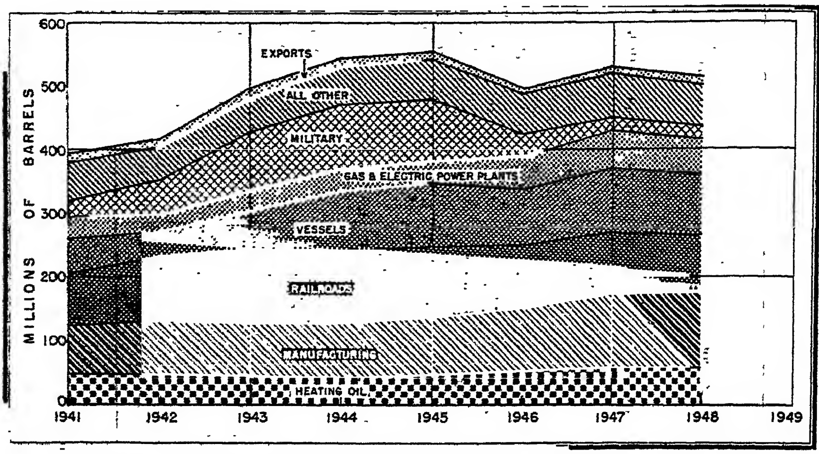

FIGURE 11.—Sales of residual fuel oil in the United States, 1941–48, by uses.

quarter, when requirements were only 108,340,000 barrels compared with 121,495,000 in the similar 3 months of 1948. There was some evidence of an upward turn in the domestic demand in the third quarter, when the total of 113,602,000 barrels was about 2 percent above the comparative item of 111,706,000 for 1948. This expansion in the demand was even more pronounced in the closing period of 1949, when requirements for residual fuel oils of 138,027,000 barrels were 10 percent higher than the 1948 total of 125,448,000 barrels. This expanded market for heavy fuel oils continued in the opening quarter of 1950, when a record domestic demand of 150,700,000 barrels was 11 percent above the 1949 total.

The Bureau of Mines report covering sales of residual fuel oils in 1949 had not been released when this review was written; however, estimates of the principal uses for the year based on reliable sources of information are as follows: Railroads, 64,000,000 barrels; vessels, 89,000,000; gas and electric power plants, 80,000,000; smelters, mines, and manufacturing industries, 124,900,000; heating oils, 58,600,000; military uses, 17,500,000; oil-company uses, 55,000,000; and miscellaneous uses, 6,300,000 barrels.

Sales of residual fuel oil declined by about 4 percent from 520,529,000 barrels in 1947 to 502,051,000 in 1948. Purchases of heavy fuel oils by railroads, vessels, and gas and electric utilities and the quantity used by oil companies were down sharply, while amounts credited to smelters, mines, and manufacturing industries, for space heating, and for military uses showed nominal gains.

In their shift to Diesel power, the railroads bought 8 percent less heavy fuel oil in 1948 than in 1947, while quantities sold for bunkering vessels were lower by 6 percent. Sales of residual grades of fuel oil to public utilities in 1948 were 7 percent below the 1947 total; however, this was a net decline, as the gas-manufacturing companies consumed more in 1948 than in 1947, while the total for the electric power

companies was down sharply. Although petroleum-industry activities were at a higher level in 1948 than in 1947, the quantity of heavy fuel oil used by oil companies was 10 percent below 1947 requirements, probably partly due to the demand for supplies in some areas in early 1948 and also the greater use of natural gas and refinery gas as refinery fuels.

The upward trend in sales of heavy fuel oils to smelters, mines, and manufacturing plants of recent years continued in 1948, when the total was 2 percent above the 1947 demand. Residual fuel oils reported for space heating in 1948 were 4 percent greater in volume than in 1947; and the quantity credited for military uses, which has dropped sharply in recent years, turned upward again in 1948 by about 6 percent.

TABLE 74.—Sales of residual fuel oil [1] in the United States, 1944–48, by uses [2]

[Thousands of barrels]

Use	1944	1945	1946	1947	1948
Railroads	114, 535	112, 297	100, 305	97, 500	89, 588
Ships' bunkers (including tankers)	92, 069	100, 365	88, 185	101, 900	95, 763
Gas and electric power plants	34, 476	34, 532	50, 921	60, 964	56, 812
Smelters, mines, and manufacturing industries	86, 664	91, 176	99, 011	115, 108	117, 780
Heating oils	40, 474	43, 874	49, 734	56, 402	58, 639
U. S. Navy, Army, and Coast Guard	101, 347	97, 485	35, 822	19, 147	20, 209
Oil-company fuel	55, 363	57, 336	58, 054	62, 649	56, 637
Miscellaneous uses	4, 484	5, 200	5, 028	6, 859	6, 623
Total United States	[3] 529, 412	[3] 542, 265	487, 060	520, 529	502, 051
Exports and shipments to noncontiguous Territories	12, 536	11, 669	9, 188	10, 623	13, 011
Total	541, 948	553, 934	496, 248	531, 152	515, 062

[1] Includes Navy grade and crude oil burned as fuel.
[2] Figures for 1949 not available when table was compiled.
[3] These totals involve some duplication owing to rehandling of fuel oil initially sold to the Government.

Less residual fuel oil was sold in all regions of the country in 1948 than in 1947, except in the North Central and New England areas, where nominal gains were reported. Over a quarter of the 1948 total (26 percent) was credited to the Middle Atlantic States, where the quantity was 2 percent below 1947 requirements. Sales in the Pacific coast area declined by 13 percent and represented 23 percent of the residual fuel-oil deliveries in 1948. A similar proportion was marketed in the South Central States, but there the 1948 volume was down by less than 2 percent. In areas where gains were reported in 1948, the sales in the North Central States were greater by 6 percent and in New England 4 percent. Deliveries of residual fuel oil in these areas made up about 13 and 8 percent, respectively, of the national total in 1948. Sales of heavy fuel oils in the South Atlantic and Rocky Mountain States are relatively unimportant, and the quantities declined in 1948 compared with 1947.

Figure 11 shows graphically the changing demands for residual fuel oils in recent years. All grades of heavy fuel oils are included, including crude petroleum used as fuel.

TABLE 75.—Sales of residual fuel oil [1] in the United States, 1944–48, by States [2]

[Thousands of barrels]

Region [3] and State	1944	1945	1946	1947	1948
Pacific Coast:					
Washington	12,896	13,615	12,856	14,149	13,203
Oregon	15,638	17,205	14,662	15,482	14,892
California	116,127	129,514	92,039	90,916	79,081
Arizona	2,905	2,706	2,618	3,491	1,841
Nevada	7,507	6,626	5,823	5,957	4,372
Rocky Mountain:					
Idaho	580	557	490	460	456
Montana	5,460	6,253	6,274	5,444	4,935
Wyoming	5,327	4,710	4,365	3,741	3,877
Utah	1,202	1,396	1,324	1,486	1,585
Colorado	1,489	1,262	1,237	1,218	886
New Mexico	755	1,184	1,112	840	685
North Central:					
North Dakota	104	623	572	414	447
South Dakota	226	241	306	257	288
Minnesota	1,219	1,106	1,089	1,022	1,315
Nebraska	556	581	491	378	329
Iowa	913	882	1,029	777	742
Wisconsin	1,806	1,671	1,610	1,358	1,497
Illinois	15,540	15,092	15,130	17,047	15,276
Indiana	11,776	12,118	11,825	12,386	13,497
Michigan	6,506	6,482	5,760	7,046	11,051
Ohio	10,897	11,534	13,651	16,534	16,089
Kentucky	1,022	926	1,005	824	1,303
Tennessee	1,580	1,550	813	1,015	890
South Central:					
Missouri	6,030	5,971	5,164	6,920	6,609
Kansas	10,754	10,584	9,948	11,224	10,166
Texas	79,495	81,758	66,466	66,789	63,376
Oklahoma	8,787	3,314	8,157	8,276	7,723
Arkansas	3,110	2,321	2,331	2,253	2,080
Louisiana	14,003	13,416	13,052	14,835	19,434
Mississippi	618	505	294	343	411
Alabama	2,468	3,131	3,180	3,294	2,296
New England:					
Maine	2,061	1,718	2,258	2,809	2,342
New Hampshire	701	536	768	959	909
Vermont	107	142	203	262	258
Massachusetts	16,595	14,513	14,711	16,976	18,003
Rhode Island	4,008	4,168	5,576	7,088	6,789
Connecticut	4,347	4,934	7,117	8,838	10,066
Middle Atlantic:					
New York	25,635	27,105	30,380	32,907	45,871
New Jersey	56,143	49,272	42,814	46,167	33,680
Pennsylvania	32,529	35,210	35,097	35,794	37,240
Delaware	879	1,173	1,044	1,139	1,043
Maryland	12,287	12,889	14,604	17,119	13,276
District of Columbia	759	866	1,073	935	855
South Atlantic:					
Virginia	6,643	5,943	6,402	11,298	7,503
West Virginia	980	888	482	828	1,171
North Carolina	384	504	643	433	461
South Carolina	1,029	790	2,112	2,349	2,445
Georgia	2,807	2,821	3,018	2,933	3,375
Florida	14,222	14,959	14,085	15,519	16,132
Total	[4] 529,412	[4] 542,265	487,060	520,529	502,051

[1] Includes some crude oil burned as fuel.
[2] Figures for 1949 not available when table was compiled.
[3] States are grouped according to petroleum-marketing territories rather than to conventional geographic regions.
[4] These totals involve some duplication owing to rehandling of fuel oil initially sold to the Government.

Exports of residual fuel oil which have increased moderately in recent years declined in 1949 to 12,641,000 barrels compared with 13,011,000 in 1949—a 3-percent drop, according to reports published by the Bureau of the Census, United States Department of Commerce. The largest shares of the 1949 quantity were credited to Canada, 2,819,000 barrels; Mexico, 1,361,000; Cuba, 1,297,000; Chile, 934,000; and Guatemala, 449,000 barrels.

Residual fuel-oil production in 1948—466,317,000 barrels—and the yield of 23 percent were based only on the crude runs to stills, while in 1949 the output of 424,829,000 and the yield of 21.7 percent was figured on the quantity of crude plus unfinished oils rerun. Because of this change in accounting, the production and percentage yields of residual fuel oils in 1948 and 1949 are not comparable. The production and percentage yields for heavy fuel oils, by months and refinery districts, in 1948 and 1949 are shown in the table of salient statistics.

"Transfers" or crude oil generally considered used as fuel on leases and for industrial purposes declined from 23,847,000 barrels in 1948 to 4,750,000 in 1949. The quantities for refinery districts east of California were 4,564,000 barrels in 1948 and 3,033,000 in 1949, while the total for California dropped from 19,283,000 in 1948 to 1,717,000 in 1949. The totals for the California refinery district are not comparable as, beginning with January 1949, crude petroleum intended for charging cracking units was eliminated from this account, leaving only the crude petroleum actually used for fuel purposes. Adjusted "transfers" of 2,135,000 barrels for the California refinery district in 1948 are comparable with the 1949 item shown above.

Imports of residual fuel oil increased from 53,269,000 barrels in 1948 to 74,555,000 in 1949—a 40-percent gain. These receipts from foreign sources represented about 10 percent of the total available supply of heavy fuel oils in 1948 and a 15-percent share in 1949. Most of the residual fuel oil received from abroad comes from the Netherlands Antilles, while many other countries, such as Canada, Mexico, Trinidad, Venezuela, Colombia, Saudi Arabia, and Bahrein, are credited with small amounts.

Year-end stocks of residual fuel oils of 76,970,000 barrels in 1948 and 60,193,000 for 1949 are not comparable, because of some changes in accounting methods in the California refinery district initiated in January 1949, namely, the transfer of heavy fuel oils used for cracking stock to "other unfinished oils" and the elimination of certain stocks held in distributors' tanks formerly included in bulk terminal stocks. The table of salient statistics for residual fuel oil shows these stocks by months and refinery districts in 1948 and 1949.

There is a small overland movement of residual fuel oil by rail and truck between the California refinery district and other Western States. California shipped out 243,000 barrels in 1948 and 104,000 in 1949 in this traffic and in turn received from other western areas 511,000 barrels of heavy fuel oil in 1948 and 543,000 in 1949.

Tanker shipments of residual fuel oil from California to the east coast rose from 97,000 barrels in 1948 to 6,419,000 in 1949. The stepped-up shipments started in August 1949 with a total of 94,000 barrels and for the month of December reached 2,126,000 barrels. This accelerated movement of heavy fuel oil from California to the east coast was an effort to find a market for excessive supplies in that area and also to take advantage of the higher prices quoted in the east coast. As an example the quotation for Bunker "C" at San Pedro was $1.60 a barrel in August 1949 and had dropped to $1.25 a barrel in the final quarter of the year, while at New York the same grade rose from $1.60 a barrel in July 1949 to $2.05 in November and December. This traffic in heavy fuel oil from California to the east

coast has continued during the January–April period of 1950, when the total reached 9,241,000 barrels.

Tanker and barge shipments of residual fuel oil from the Gulf coast to the east coast declined from 68,662,000 barrels in 1948 to 67,425,000 in 1949, according to statistics compiled by the Oil and Gas Division, United States Department of the Interior. The quantity originating in Texas increased from 55,325,000 barrels in 1948 to 56,996,000 in 1949, while the total credited to Louisiana declined from 12,907,000 barrels in 1948 to 10,429,000 in 1949. Alabama shipped 430,000 barrels in this traffic in 1948 and none in 1949.

Some heavy fuel oil is also barged up the Mississippi River and its tributaries from the Gulf coast and Arkansas to terminals in districts 1, 2, and 3. The total for 1949—1,111,000 barrels—varied only slightly from the 1948 quantity of 1,057,000 barrels. Texas supplied 46,000 barrels of these 1949 barge shipments compared with 105,000 in 1948; Louisiana, 972,000 barrels in 1949 and 896,000 in 1948; and Arkansas and Mississippi, 93,000 barrels in 1949 and 56,000 in 1948. District 1 received 117,000 barrels over these inland waters from the Gulf area in 1949 and 224,000 in 1948; district 2, 865,000 barrels in 1949 and 659,000 in 1948; district 3, 129,000 barrels in 1949 and 174,000 in 1948.

Tanker rates for Bunker "C" fuel oil shipped from the Gulf coast to New York were changed numerous times in 1949, according to quotations published in Platt's Oil Price Handbook for 1949. Vessels of over 14,000 tons deadweight were charging $2.565 a long ton or 39.5 cents a barrel on December 31, 1948. As the demand for heavy fuel oil declined in the summer months of 1949, the Gulf-New York tanker rate declined to 18.6 cents a barrel on July 8 and then slowly rose to a year-end charge of 37.2 cents a barrel on December 15. The weighted average rate for all of 1949 was 28 cents a barrel compared with 58.3 cents in 1948.

The average monthly prices of representative grades of residual fuel oils, which trended upward in 1948, took a sharp drop in 1949. The price of No. 6 fuel oil at refineries in Oklahoma, which was selling at an average monthly price of $1.87 a barrel in December 1948, dropped steadily to 90 cents a barrel for July 1949. It went up slightly to 97 cents in August but declined again to 82 cents a barrel in September. The year-end demand finally pulled the quotation up to $1.03 a barrel for December. The weighted average for this grade was $1.08 a barrel for all of 1949 compared with $2.44 in 1948. No. 5 grade at New York Harbor followed a similar price pattern, dropping from a December 1948 price of $3.39 a barrel to $2.38 in June and July 1949. It gradually rose to $2.79 a barrel in November and then dropped to $2.74 in the final month of the year. The average quotation for 1949 was $2.69 against $3.71 a barrel in 1948. The price of Bunker "C" to vessels bunkering in New York Harbor was $2.78 in December 1948 and averaged $3.00 for that year. It declined to $1.60 a barrel in June and July 1949 and was up to $2.05 at the year end and averaged $1.90 for all of 1949. Bunker "C" at New Orleans varied from $2.32 in December 1948 to $1.32 in June 1949 and $1.75 in the final two months. The weighted average quotation at New Orleans was $2.51 a barrel for 1948 and $1.57 in 1949. The San Pedro price for Bunker "C" declined from the December 1948 value of $2.18 a barrel to $1.25 in the final quarter of 1949.

TABLE 76.—Monthly average prices of residual fuel oil in the United States, 1948–49

[Platt's Oil Price Handbook]

Year and grade	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1948													
No. 6 fuel oil at refineries, Oklahoma ....dollars per barrel..	2.70	2.80	2.87	2.73	2.63	2.63	2.58	2.38	2.15	2.02	1.90	1.87	2.44
No. 5 fuel oil at New York Harbor ....do....	3.60	3.72	3.79	3.82	3.82	3.82	3.82	3.77	3.74	3.70	3.56	3.39	3.71
Bunker "C" for ships:													
New York ....do....	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	2.98	2.78	3.00
New Orleans ....do....	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.49	2.32	2.51
San Pedro ....do....	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.13	2.18	2.11
1949													
No. 6 fuel oil at refineries, Oklahoma ....do....	1.70	1.49	1.43	1.19	1.10	.92	.90	.97	.82	.92	.90	1.03	1.08
No. 5 fuel oil at New York Harbor ....do....	3.17	3.08	2.82	2.56	2.46	2.38	2.38	2.45	2.70	2.78	2.79	2.74	2.69
Bunker "C" for ships:													
New York ....do....	2.42	2.09	1.95	1.83	1.70	1.60	1.60	1.69	1.82	1.96	2.05	2.05	1.90
New Orleans ....do....	2.01	1.61	1.53	1.44	1.36	1.32	1.37	1.45	1.54	1.68	1.75	1.75	1.57
San Pedro ....do....	2.17	2.00	1.98	1.85	1.85	1.60	1.60	1.60	1.30	1.25	1.25	1.25	1.64

Retail prices of heavy fuel oils also followed a downward trend in 1949, according to records published monthly by the Bureau of Labor Statistics, United States Department of Labor. No. 6 grade, which was selling for an average of 8.08 cents a gallon in New York in December 1948, declined through a number of price cuts to an average of 4.66 cents by July, 1949. There was a gradual upturn during the second half of the year to 5.91 cents in December and an average of 5.59 cents a gallon for all of 1949 compared with an average of 9.22 cents a gallon for this grade in New York for 1948. No. 5 heavy fuel oil at Chicago was quoted at 10.47 cents a gallon during December 1948; however, by the third quarter of 1949, the retail price had dropped to 7.80 cents a gallon. There was a slight rise during the final quarter to 8.31 cents in December and an average of 8.66 cents a gallon for the entire year compared with 10.78 cents in 1948.

LUBRICANTS

The refinery production of lubricants dropped from 51.8 million barrels in 1947 to 51.4 million in 1948 and 45.4 million in 1949. The total decline in production of 6.0 million barrels in 1949 included gains of 0.8 million in the California district and 0.3 million in the Louisiana Gulf district while production in all other districts declined, including decreases of 2.5 million barrels in the east coast district, 2.3 million in the Oklahoma-Kansas district, 1.0 million in the Texas Gulf district, and 0.8 million in the Indiana-Illinois district. Production in the Appalachian district was almost static.

TABLE 77.—Salient statistics of lubricants in the United States, 1948–49, by months and districts

Month and district	Production (thousand barrels)		Yield (percent)		Domestic demand (thousand barrels)		Stocks, end of period (thousand barrels)	
	1948	1949 [1]	1948	1949 [1]	1948	1949 [1]	1948	1949 [1]
By months:								
January	4,287	4,193	2.6	2.4	3,021	2,597	7,892	10,326
February	4,132	3,638	2.6	2.4	2,998	2,195	7,829	10,856
March	4,404	3,698	2.6	2.2	3,192	2,426	7,961	10,931
April	4,308	3,457	2.6	2.2	3,057	2,623	8,022	10,588
May	4,500	3,606	2.6	2.2	2,923	2,752	8,411	10,089
June	4,065	3,804	2.4	2.5	2,972	3,023	8,166	9,922
July	4,135	3,554	2.4	2.2	2,773	2,699	8,350	9,731
August	4,341	3,510	2.5	2.1	2,928	3,111	8,747	8,962
September	4,121	3,729	2.6	2.3	2,818	3,026	8,884	8,734
October	4,580	4,116	2.6	2.4	3,150	2,927	9,306	8,894
November	4,175	3,984	2.4	2.4	3,210	2,982	9,512	9,109
December	4,368	4,100	2.5	2.4	2,946	2,647	9,843	9,219
Total	51,416	45,389	2.5	2.3	35,983	33,008	9,843	9,219
By districts:								
East Coast	11,163	8,645	3.5	3.0	(2)	(2)	3,158	2,327
Appalachian	5,068	5,053	8.8	8.9			817	866
Indiana, Illinois, Kentucky, etc.	5,042	4,291	1.5	1.3			999	1,089
Oklahoma, Kansas, etc	6,131	3,823	3.7	2.4			835	730
Texas Inland	383	198	.4	.3			98	44
Texas Gulf Coast	16,129	15,128	3.2	3.3			2,769	2,562
Louisiana Gulf Coast	1,978	2,242	1.2	1.4			244	423
Arkansas, Louisiana Inland, etc	1,376	1,105	4.5	3.9			189	154
Rocky Mountain	300	235	.5	.4			108	103
California	3,846	4,669	1.2	1.4			635	921
Total	51,416	45,389	2.5	2.3	35,983	33,008	9,843	9,219

[1] Preliminary figures.
[2] Figures not available.

The total demand for lubricants declined from 49.4 million barrels in 1948 to 46.0 million in 1949. Exports decreased from 13.4 million to 13.0 million and domestic demand declined from 36.0 million barrels in 1948 to 33.0 million in 1949. The greater relative decline in production than in demand was due to an increase in total stocks of 2.1 million barrels in 1948 compared with a stock decrease of 0.6 million in 1949.

The downward trend in the domestic demand for lubricants, in spite of the rapid increase in the number of motor vehicles and the gain in gasoline consumption, is difficult to explain. No current figures are available as to the relative demand for industrial and automotive uses. Factors affecting automotive demand may be the growing practice of reclaiming lubricants for reuse, less frequent changes of oil, and the reduction in the average age of motor vehicles.

The accompanying table showing the prices of representative lubricating oils for 1948 and 1949 indicate sharp declines, especially for Oklahoma and Pennsylvania grades.

TABLE 78.—Average monthly refinery prices of five selected grades of lubricating oil in the United States, 1948–49, in cents per gallon

[National Petroleum News]

Year and grade	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1948													
Oklahoma:													
200 viscosity, No. 3 color, neutral	21.25	21.25	21.25	21.25	21.25	21.11	21.00	21.00	20.14	20.00	20.00	17.11	20.55
150–160 viscosity at 210°, bright stock, 10–25 pour test	32.50	32.50	32.50	32.50	32.50	32.50	32.50	32.50	31.83	30.50	30.50	27.25	31.67
Pennsylvania:													
200 viscosity, No. 3 color, neutral, 420–425 flash, 25 pour test	41.50	41.50	41.50	41.50	41.50	41.50	41.50	41.41	28.79	35.50	35.07	29.63	39.24
600 steam-refined, cylinder stock, filterable	36.00	36.00	36.39	36.50	36.50	36.50	36.50	36.39	35.14	33.93	32.86	30.22	35.25
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	15.04	15.25	15.25	15.25	15.25	15.25	15.25	15.25	14.95	14.75	14.75	14.75	15.08
1949													
Oklahoma:													
200 viscosity, No. 3 color, neutral	16.50	15.03	14.50	14.14	13.00	13.00	12.76	12.75	12.75	12.50	12.50	12.50	13.39
150–160 viscosity at 210°, bright stock, 10–25 pour test	26.39	23.55	20.90	19.42	18.70	17.75	17.75	17.75	17.75	17.75	17.75	17.75	19.43
Pennsylvania:													
200 viscosity, No 3 color, neutral 420–425 flash, 25 pour test	25.00	24.00	23.54	21.31	17.00	17.00	17.00	17.00	17.14	17.50	17.50	17.50	19.29
600 steam-refined, cylinder stock, filterable	27.86	23.20	18.54	16.10	14.21	12.07	12.25	12.10	11.75	11.75	11.75	11.75	15.28
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	14.75	14.75	14.51	13.36	13.00	13.00	12.98	12.24	12.00	12.00	12.00	12.00	13.05

LIQUEFIED GASES

The sale of liquefied gases, included with other finished products, has expanded rapidly in the last few years and now ranks after kerosine and still gas in volume.

Liquefied gases include the transfer from natural gasoline and cycle plants of liquefied petroleum gases sold for fuel and chemical uses and the output of liquefied refinery gases. Transfers increased from 43 million barrels in 1948 to 45.7 million in 1949, while refinery production declined from 23.7 million barrels in 1948 to 23.1 million in 1949.

The total demand for liquefied gases rose from 54 million barrels in 1947 to 66.6 million in 1948 and 68.9 million barrels in 1949. Exports amounted to 1.3 million barrels in 1947, 1.1 million in 1948, and 1.3 million in 1949. Domestic demand was 52.7 million barrels in 1947, 65.5 million in 1948 and 67.6 million barrels in 1949. The increase in domestic demand, on a daily average basis, was only about 3 percent in 1949, compared with gains of 23 percent in 1948 and 33 percent in 1947. The details of the sales of liquefied gases by types and uses can be found in a separate section of the Natural Gasoline chapter of the Minerals Yearbook.

OTHER PRODUCTS

Wax.—The refinery production of wax declined from 3,515,000 barrels in 1948 to 3,208,000 in 1949, converted from pounds at the rate of 280 pounds to the barrel. The total decrease in production amounted to 307,000 barrels, representing gains of 97,000 in the California district, 90,000 in the Texas Gulf and 3,000 in the Appalachian district, and declines of 241,000 barrels in the East Coast district, 130,000 in the Oklahoma-Kansas district, 62,000 in the Louisiana Gulf, 30,000 in the Indiana-Illinois district, 29,000 in the Rocky Mountain district, and 5,000 barrels in the Texas Inland district. Production in the east coast district represented 38.2 percent of the total in 1948 and 34.3 percent in 1949.

Stock declined 78,000 barrels during 1949 and total demand amounted to 3,286,000 barrels, including exports of 1,030,000 barrels and a domestic demand of 2,256,000 barrels. The average refinery price of white crude scale wax at Pennsylvania refineries declined sharply from 8.01 cents per pound in 1948 to 4.85 cents in 1949.

TABLE 79.—Salient statistics of wax in the United States, 1948–49, by types, months, and districts

[Thousands of barrels][1]

Month and district	Production						Domestic demand (all types)		Exports (all types)		Stocks, end of period					
	1948			1949 [2]							1948			1949 [2]		
	Micro-crystalline	Fully refined	Other	Micro-crystalline	Fully refined	Other	1948	1949 [2]	1948	1949 [2]	Micro-crystalline	Fully refined	Other	Micro-crystalline	Fully refined	Other
By months:																
January	31	201	118	16	159	102	240	191	92	95	83	96	195	55	130	357
February	25	181	88	22	134	64	209	154	94	113	85	101	183	64	140	291
March	25	194	132	11	170	93	262	183	102	98	84	99	177	60	140	288
April	29	186	117	13	156	78	226	170	79	84	96	98	195	71	134	276
May	21	177	97	13	147	99	182	145	103	93	101	112	189	64	142	296
June	19	178	111	16	148	97	188	164	86	68	108	120	211	53	152	326
July	6	161	100	10	146	73	142	165	80	65	101	132	254	51	166	313
August	12	170	85	18	161	59	163	206	63	63	98	148	285	55	151	293
September	31	136	71	11	176	73	158	235	70	77	96	150	295	54	129	264
October	27	150	86	20	201	135	176	258	76	80	95	147	310	51	137	277
November	32	162	74	21	168	68	224	186	42	86	95	153	306	39	146	265
December	33	162	87	18	192	120	178	199	107	108	98	140	313	51	174	248
Total	291	2,058	1,166	189	1,958	1,061	2,348	2,256	994	1,030	98	140	313	51	174	248
By districts:																
East Coast	122	823	397	86	731	284					50	55	157	14	42	99
Appalachian	14	129	248	18	151	225					16	30	47	14	25	31
Indiana, Illinois, Kentucky, etc.	----	263	15	----	215	33					----	9	56	1	16	55
Oklahoma, Kansas, Missouri	131	109	200	59	77	174					22	4	23	15	----	14
Texas Inland	----	----	9	----	----	4	(3)	(3)	(3)	(3)	----	----	1	----	----	----
Texas Gulf Coast	13	425	25	16	433	104					6	22	1	5	65	3
Louisiana Gulf Coast	3	135	262	−1	102	237					3	6	7	1	9	25
Rocky Mountain	8	86	10	11	64	----					1	9	21	1	7	21
California	----	88	----	----	185	----					----	5	----	----	10	----
Total	291	2,058	1,166	189	1,958	1,061	2,348	2,256	994	1,030	98	140	313	51	174	248

[1] Conversion factor: 280 pounds to the barrel.
[2] Preliminary figures.
[3] Figures not available.

TABLE 80.—Average monthly refinery price 124°–126° white crude scale wax at Pennsylvania refineries, 1945–49, in cents per pound

[National Petroleum News]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1945	4.25	4.25	4.45	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1946	4.25	4.25	4.25	4.25	4.25	4.25	4.32	5.66	5.76	6.00	6.00	6.07	4.94
1947	6.19	7.06	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.85	7.88	8.03	7.61
1948	8.57	8.75	8.71	8.50	8.50	8.38	8.13	8.10	7.45	7.38	7.38	6.30	8.01
1949	5.38	5.23	5.28	5.25	4.97	4.95	4.92	4.90	4.18	3.98	4.60	4.63	4.85

Coke.—The production of petroleum coke continued to increase in 1949, amounting to 17.0 million barrels compared with 14.5 million in 1948 (converted at the rate of 5 barrels to the short ton). Output increased in all the producing districts, with gains of 0.9 million barrels in the Indiana-Illinois district, 0.4 million in the Oklahoma-Kansas district, about 0.3 million each in the California, east coast, and Rocky Mountain districts, and 0.2 million barrels in the Louisiana Gulf district. The Indiana-Illinois district is the largest producer, representing 47.6 percent of the total output in 1949 compared with 49.6 percent in 1948.

TABLE 81.—Salient statistics of petroleum coke in the United States, 1948–49, by months and districts [1]

Month and district	Production (thousand barrels)		Yield (percent)		Domestic demand (thousand barrels)		Stocks, end of period (thousand barrels)	
	1948	1949 [2]	1948	1949 [2]	1948	1949 [2]	1948	1949 [2]
By months:								
January	1,020	1,439	0.6	0.8	686	1,075	337	771
February	1,013	1,263	.6	.8	839	1,015	396	790
March	1,209	1,378	.7	.8	1,151	1,097	331	870
April	1,126	1,303	.7	.8	886	979	343	990
May	1,087	1,614	.6	1.0	869	1,186	417	1,136
June	1,281	1,409	.7	.9	1,049	1,230	457	1,142
July	1,296	1,510	.7	.9	973	1,200	502	1,203
August	1,295	1,520	.7	.9	1,010	1,237	553	1,249
September	1,228	1,337	.8	.8	1,075	1,247	544	1,180
October	1,247	1,464	.7	.9	944	1,349	574	1,085
November	1,296	1,401	.7	.9	1,124	1,502	583	802
December	1,396	1,321	.8	.8	1,064	1,310	646	698
Total	14,494	16,959	.7	.9	11,670	14,427	646	698
By districts:								
East Coast	755	1,040	.2	.4			1	----
Appalachian	317	318	.6	.6			7	12
Indiana, Illinois, Kentucky, etc.	7,183	8,067	2.2	2.4			155	174
Oklahoma, Kansas, etc.	1,005	1,406	.6	.9			39	30
Texas Inland	584	607	.6	.8	(3)	(3)	14	23
Texas Gulf Coast	1,527	1,624	.3	.4			48	60
Louisiana Gulf Coast	1,249	1,444	.8	.9			1	1
Rocky Mountain	269	526	.5	.8			11	63
California	1,605	1,927	.5	.6			370	335
Total	14,494	16,959	.7	.9	11,670	14,427	646	698

[1] Conversion factor: 5.0 barrels to the short ton.
[2] Preliminary figures.
[3] Figures not available.

The total demand for petroleum coke amounted to 16.9 million barrels in 1949—a gain of 2.7 million compared with 1948. Domestic demand increased from 11.7 million barrels in 1948 to 14.4 million in 1949, while exports were about the same.

Asphalt and Road Oil.—The total demand for asphalt declined from 51.6 million barrels in 1948 to 50.9 million in 1949 (converted at the rate of 5.5 barrels to the short ton). Domestic demand decreased from 50.0 million barrels in 1948 to 49.4 million in 1949, while there was a small decline in exports. The domestic demand for road oil amounted to 8.0 million barrels in 1948 and 7.8 million in 1949. The details as to total sales of asphalt and types of product are contained in a separate chapter.

Still Gas.—The production of still gas increased from 81.2 million barrels equivalent in 1948 to 82.6 million in 1949. Production, in cubic feet, rose from 292.2 billion in 1948 to 297.4 billion in 1949.

TABLE 82.—Production of still gas in the United States, 1947–49, by districts

District	1947		1948		1949 [1]	
	Million cubic feet	Equivalent, in thousand barrels	Million cubic feet	Equivalent, in thousand barrels	Million cubic feet	Equivalent, in thousand barrels
East Coast	42,084	11,690	34,168	9,491	36,637	10,177
Appalachian	12,301	3,417	10,879	3,022	12,110	3,364
Indiana, Illinois, Kentucky, etc.	56,088	15,580	56,117	15,588	64,127	17,813
Oklahoma, Kansas, etc.	23,951	6,653	23,360	6,489	20,693	5,748
Texas Inland	14,609	4,058	14,526	4,035	13,533	3,759
Texas Gulf Coast	87,192	24,220	82,087	22,802	80,640	22,400
Louisiana Gulf Coast	20,289	5,636	20,642	5,734	18,756	5,210
Arkansas, Louisiana Inland, etc.	5,252	1,459	5,198	1,444	3,733	1,037
Rocky Mountain	7,956	2,210	8,039	2,233	7,243	2,012
California	38,308	10,641	37,156	10,321	39,964	11,101
Total	308,030	85,564	292,172	81,159	297,436	82,621

[1] Preliminary figures.

Miscellaneous Finished Products.—The production of miscellaneous finished products at refineries in the United States amounted to 4,031,000 barrels in 1949, compared with 6,188,000 barrels in 1948. This decline reflects in part a decrease in refinery operations and demand for specialty products in 1949. The abrupt decline in production of "other" miscellaneous products from 2,453,000 barrels in 1948 to 597,000 barrels in 1949 is accounted for chiefly by reclassification of certain products formerly reported in this group to other types of finished products. In some instances these materials were utilized for specialized purposes but are appropriately classed with motor fuel as light fuel oils on the basis of quality.

TABLE 83.—Production of miscellaneous finished oils in the United States in 1949, by districts and classes

[Thousands of barrels]

District	Petrolatum	Absorption oil	Medicinal oil	Specialties	Solvents	Other	Total
East Coast	43	9	67	124	76		319
Appalachian	166	19	12	16	2		215
Indiana, Illinois, Kentucky, etc.	49			608		99	756
Oklahoma, Kansas, etc.	323	149		14	32		518
Texas Inland	11	395		17			423
Texas Gulf Coast	140	213		49	30		432
Louisiana Gulf Coast	2	8					10
Arkansas, Louisiana Inland, etc.		198			18		216
Rocky Mountain	1					9	10
California		10	38	579	16	489	1,132
Total	735	1,001	117	1,407	174	597	[1] 4,031

[1] Difference between the refinery output of other finished products and this total is due to reclassification of products.

INTERCOASTAL SHIPMENTS [2]

Shipments of mineral oils, crude and refined, from Gulf coast ports to east coast ports were 9 percent lower in 1949 than in 1948. Crude petroleum was the largest single item in 1948; it constituted 35 percent of the total shipments. But a 27-percent decrease of these intercoastal shipments of crude petroleum caused it to drop to second place; it made up only 28 percent of the total in 1949. Gasoline, which held second place in 1948 with 26 percent of the total, gained first place in 1949 with 30 percent of the total.

The decreased shipments of crude petroleum from the Gulf coast to the east coast may be ascribed to smaller refinery runs and to greater receipts of foreign crude at east coast refineries. Greater demand for gasoline on the east coast caused the 7-percent increase in intercoastal shipments of motor fuel. Shipments of other refined products from the Gulf coast to the east coast were all lower in 1949 than in 1948; for kerosine the decrease was 12 percent.

Intercoastal shipments of refined oils from California to east coast ports, which had amounted to only 740,000 barrels in 1946 and 945,000 barrels in 1947, increased from 2,088,000 barrels in 1948 to 7,566,000 barrels in 1949. The principal items in these shipments during 1949 were residual fuel oil (6,419,000 barrels), gasoline (742,000 barrels), and lubricating oils (273,000 barrels).

[2] By A. H. Redfield, Petroleum and Natural Gas Branch, Bureau of Mines.

TABLE 84.—Mineral oils, crude and refined, shipped commercially from Gulf-coast to east-coast ports of the United States, 1948–49, by classes [1]

[Thousands of barrels]

Year and class	January	February	March	April	May	June	July	August	September	October	November	December	Total
1948													
Crude petroleum	17,257	15,862	19,044	17,460	18,748	17,688	15,859	15,365	15,501	15,070	15,856	13,053	196,763
Gasoline	10,263	10,106	11,888	13,587	13,657	12,799	12,944	12,795	11,666	11,471	12,779	11,890	145,790
Kerosine	4,763	3,562	3,500	3,592	3,067	2,576	3,751	2,524	2,531	2,444	3,787	3,923	40,020
Distillate fuel oil	13,471	11,906	10,612	7,117	7,061	7,821	6,740	7,194	5,903	6,865	9,618	10,401	102,609
Residual fuel oil	6,499	6,052	6,753	5,392	6,280	4,976	5,233	4,959	4,068	5,671	5,913	6,866	68,662
Lubricating oils	821	500	688	679	591	542	535	662	468	634	704	838	7,657
Miscellaneous oils	303	310	369	242	332	610	430	536	405	445	237	305	4,524
Total	53,377	48,298	52,744	48,019	49,736	47,012	45,492	44,035	40,542	42,600	48,894	47,276	566,025
1949													
Crude petroleum	13,648	12,250	13,149	12,479	12,319	8,382	11,704	11,437	12,071	12,300	10,353	12,931	143,023
Gasoline	11,585	10,849	12,334	13,143	14,320	14,170	13,486	12,127	13,462	13,896	13,752	12,466	155,590
Kerosine	3,917	2,772	2,816	2,644	2,434	1,546	3,311	2,056	2,448	3,324	3,228	4,549	35,045
Distillate fuel oil	11,921	10,508	8,355	7,879	6,829	5,395	5,874	8,157	7,355	8,201	9,591	12,082	102,147
Residual fuel oil	6,677	6,322	6,281	4,941	5,704	4,564	5,257	5,195	4,945	4,914	6,389	6,236	67,425
Lubricating oils	868	428	524	476	744	826	555	620	581	592	560	514	7,288
Miscellaneous oils	400	224	222	385	284	548	265	294	421	361	413	526	4,343
Total	49,016	43,353	43,681	41,947	42,634	35,431	40,452	39,886	41,283	43,588	44,286	49,304	514,881

[1] Oil and Gas Division, U. S Department of the Interior.

FOREIGN TRADE [3]

Imports of mineral oils, crude and refined, into continental United States increased 24 percent from 1948 to 1949. They constituted 8 percent of the total new supply in continental United States in 1948 and 10 percent in 1949. Total imports exceeded total exports by 40 percent in 1948 and by 96 percent in 1949.

Crude petroleum, distillate fuel oil, and residual fuel oil together made up 98 percent of the total mineral-oil imports into continental United States in 1948 and 99 percent in 1949. Crude petroleum alone constituted 69 percent of the total in 1948 and 66 percent in 1949. Venezuela supplied 50 percent of the total imports into the United States in 1948 and 44 percent in 1949; the Netherlands Antilles 30 percent both in 1948 and 1949; and Mexico 3 percent in 1948 and 4 percent in 1949. A newer source of supply, the countries surrounding the Persian Gulf, furnished 12 percent of the total in 1948 and 16 percent in 1949.

Of the crude petroleum imported into continental United States, Venezuela furnished 69 percent of the total in 1948 and 63 percent in 1949; the Netherlands Antilles 4 percent in 1948 and 3 percent in 1949; Colombia 7 percent both in 1948 and in 1949; and Mexico 3 percent in 1948 and 4 percent in 1949. Countries surrounding the Persian Gulf supplied 18 percent of the total in 1948 and 23 percent in 1949.

The Netherlands Antilles provided 94 percent of the residual fuel oil imported into continental United States and the noncontiguous territories in 1948 and more than 92 percent in 1949. Venezuela furnished an additional 5 percent in 1949 and other countries of the Western Hemisphere 2 percent.

Caribbean countries and Mexico, which had shipped 76 percent of the distillate fuel oil received in continental United States and the noncontiguous territories in 1948, accounted for 69 percent of such imports in 1949. Middle eastern countries, which had supplied 24 percent of the total distillate imports in 1948, furnished 28 percent in 1949.

[3] By A. H. Redfield, Petroleum and Natural Gas Branch, Bureau of Mines.

TABLE 85.—Mineral oils, crude and refined, imported into continental United States, 1948–49, by months [1]

[Thousands of barrels]

Class	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1948													
Crude petroleum	8,427	8,354	8,682	9,757	10,293	9,749	11,478	10,883	11,428	12,572	12,923	14,547	129,093
Refined products:													
Gasoline, finished	17	----	55	----	----	----	----	----	----	194	18	18	302
Kerosine	----	----	135	----	----	----	----	----	----	----	----	----	135
Distillate fuel oil	107	585	322	71	466	412	66	3	----	270	233	11	2,546
Residual fuel oil	5,093	5,452	5,205	4,686	3,734	3,574	4,123	4,478	4,332	3,106	4,112	5,374	53,269
Lubricating oil	----	----	----	----	----	----	----	----	----	----	----	101	101
Paraffin wax	5	4	4	2	3	3	3	3	----	----	----	----	27
Asphalt	60	68	98	108	429	1	221	133	68	228	117	26	1,557
Unfinished oils, other	197	177	279	181	82	21	12	5	2	78	75	5	1,114
Total	13,906	14,640	14,780	14,805	15,007	13,760	15,903	15,505	15,830	16,448	17,478	20,082	188,144
1949 [2]													
Crude petroleum	14,131	12,485	11,085	11,952	12,669	12,000	13,258	12,795	11,228	15,242	13,036	15,041	154,922
Refined products:													
Distillate fuel oil	116	----	2	----	175	382	219	195	245	179	145	62	1,720
Residual fuel oil	5,131	4,296	4,939	5,621	4,860	5,385	5,705	5,985	7,081	8,181	7,316	10,055	74,555
Asphalt	102	53	41	97	39	158	142	67	132	175	133	45	1,184
Unfinished oils, other	6	5	125	114	----	2	12	2	2	545	457	480	1,750
Total	19,486	16,839	16,192	17,784	17,743	17,927	19,336	19,044	18,688	24,322	21,087	25,683	234,131

[1] Imports of crude as reported to Bureau of Mines; imports of refined products compiled from records of U. S. Department of Commerce; figures may differ slightly from those used throughout other sections of this report.
[2] Preliminary figures.

TABLE 86.—Crude petroleum and major petroleum products imported for consumption into continental United States in 1949, by countries, in thousands of barrels

[U. S. Department of Commerce]

Country	Crude petroleum	Motor fuel [1]	Distillate oil [2]	Residual oil [3]	Unfinished oil	Total
North America:						
Canada	(4)	71	4	458	75	608
Mexico	4,250			333	4,262	8,845
Netherlands Antilles		1	926	71,571	2	72,500
Trinidad and Tobago	89	17	472	718		1,296
Total	4,339	89	1,402	73,080	4,339	83,249
South America:						
Colombia	11,425		76	114		11,615
Venezuela	101,825		225	4,194	71	106,315
Total	113,250		301	4,308	71	117,930
Europe: United Kingdom	2	(4)				2
Asia:						
India				5		5
Indonesia	(4)					(4)
Iran	1,356		(4)			1,356
Iraq	344					344
Kuwait	23,075		2			23,077
Saudi Arabia	12,460		352	4		12,816
State of Bahrein			308			308
Total	37,235		662	9		37,906
Africa: Spanish				2		2
Grand total	154,826	89	2,365	77,399	4,410	239,089
Imports into noncontiguous Territories from foreign countries:						
Hawaii			541			541
Puerto Rico		19		2,282	2	2,303
Total		19	541	2,282	2	2,844
Total net imports into continental United States	154,826	70	1,824	75,117	4,408	236,245

[1] Includes naphtha and benzol.
[2] Includes free for supplies of vessels and aircraft.
[3] Includes free for manufacture in bond and export, and for supplies of vessels and aircraft.
[4] Less than 1,000 barrels.

EXPORTS

Continental United States, formerly a net exporter of mineral oils, continued in 1949 to be a net importer. The excess of all petroleum imports over all petroleum exports—53 million barrels in 1948—was increased in 1949 to nearly 115 million barrels, as more crude petroleum and residual fuel oil were imported and exports of other refined products were reduced by the general shortage of dollar credits in foreign countries and the competition of new, enlarged, and rehabilitated refineries in Europe and the Middle East.

The excess of imports was chiefly in crude petroleum, increasing from 89 million barrels in 1948 to 122 million barrels in 1949, and in residual fuel oil, increasing from 40 million barrels in 1948 to 62 million barrels in 1949. With regard to other refined products, however, exports exceeded imports by 76 million barrels in 1948 and 69 million barrels in 1949.

TABLE 87.—Mineral oils, crude and refined, shipped from continental United States, including shipments to noncontiguous Territories, 1948–49, by classes and months [1]

[Thousands of barrels]

Year and class	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1948													
Crude petroleum	2,992	2,626	3,138	3,538	3,362	3,419	3,661	3,974	3,362	3,404	3,192	3,068	39,736
Refined products:													
Motor fuel [2]	2,315	1,736	2,610	3,613	3,644	3,377	4,298	3,354	3,300	2,875	2,913	3,267	37,302
Kerosine	228	128	339	98	549	263	403	381	300	146	374	286	3,495
Distillate fuel oil	1,739	1,241	1,767	1,907	2,355	2,258	2,468	2,167	1,291	1,493	1,336	1,271	21,293
Residual fuel oil	614	798	821	1,337	1,031	1,169	1,279	1,459	1,227	1,328	901	1,047	13,011
Lubricants	1,075	1,202	1,080	1,190	1,188	1,338	1,178	1,016	1,166	1,008	759	1,192	13,392
Paraffin wax	92	94	101	80	103	86	80	63	70	76	42	107	994
Coke	340	115	123	228	144	192	278	234	162	273	163	269	2,521
Asphalt	103	224	159	130	113	145	138	143	164	149	42	118	1,628
Miscellaneous oils	117	109	109	123	83	107	96	119	102	105	102	130	1,302
Total refined	6,623	5,647	7,109	8,706	9,210	8,935	10,218	8,936	7,782	7,453	6,632	7,687	94,938
Total crude and refined	9,615	8,273	10,247	12,244	12,572	12,354	13,879	12,910	11,144	10,857	9,824	10,755	134,674
1949 [3]													
Crude petroleum	2,127	1,942	1,866	3,655	2,872	3,071	2,866	3,403	2,619	2,916	3,010	2,722	33,069
Refined products:													
Motor fuel [2]	3,995	3,660	4,204	3,832	4,231	3,528	2,399	4,020	2,613	2,867	2,266	1,859	39,474
Kerosine	255	504	213	310	290	82	120	196	134	111	161	156	2,532
Distillate fuel oil	1,546	1,246	1,685	1,165	866	869	694	1,034	832	846	875	531	12,189
Residual fuel oil	1,047	967	1,196	871	1,314	1,037	1,191	811	745	1,193	1,046	1,223	12,641
Lubricants	1,113	913	1,197	1,177	1,353	948	1,046	1,168	931	1,029	787	1,343	13,005
Paraffin wax	95	113	98	84	93	68	65	63	77	80	86	108	1,030
Coke	239	229	201	204	282	173	249	237	159	210	182	115	2,480
Asphalt	123	111	152	191	148	130	42	150	141	181	75	108	1,552
Miscellaneous oils	129	123	128	103	104	128	133	135	141	121	107	146	1,498
Total refined	8,542	7,866	9,074	7,937	8,681	6,963	5,939	7,814	5,773	6,638	5,585	5,589	86,401
Total crude and refined	10,669	9,808	10,940	11,592	11,553	10,034	8,805	11,217	8,392	9,554	8,595	8,311	119,470

[1] Compiled from records of U. S. Department of Commerce; figures may differ slightly from those used throughout other sections of this report.
[2] Includes benzol, natural gasoline, and antiknock compounds.
[3] Preliminary figures.

Exports of crude petroleum decreased 17 percent from 1948 to 1949. Canada received 84 percent of the exports in 1948 and 91 percent in 1949. France, which in 1939 took 21 percent of the crude-oil exports of the United States, took 8 percent in 1948 but only a little more than 1 percent in 1949. Cuba accounted for 4 percent of the total in 1948 and 5 percent in 1949 and the United Kingdom for a little more than 1 percent in both years. None was shipped to the noncontiguous territories.

Exports and territorial shipments of refined oils as a whole were 9 percent lower in 1949 than in 1948. Decreases and increases varied considerably among the major products.

Motor-fuel exports and shipments were 6 percent larger in 1949 than in 1948. Increased exports to Mexico, Central America, and the West Indies, to South America, to western Europe (except United Kingdom), to Africa, and to Australia offset decreased exports to eastern Asia and to the United Kingdom.

TABLE 88.—Crude petroleum and major petroleum products exported from continental United States, in 1949, by countries of destination, and shipments to and exports from noncontiguous Territories, in thousands of barrels [1] [2]

[U. S. Department of Commerce]

Destination	Crude petroleum	Motor fuel [3]	Kerosine	Distillate oil	Residual oil	Lubricating oil	Wax	Total
North America:								
Bermuda		100	4	31		5		140
Canada	29,996	8,289	736	2,746	2,819	461	86	45,133
Canal Zone	4	96	30	296	210	9	(4)	645
Cuba	1,759	2,113	(4)	298	1,297	111	15	5,593
El Salvador		69	7	11	89	7	3	186
Guatemala		82	9	73	449	16	13	642
Mexico	43	2,602	103	424	1,361	396	151	5,080
Netherlands Antilles		1,815					(4)	1,815
Trinidad and Tobago		324	(4)			16	1	341
Other North America		397	18	125	219	127	11	897
Total	31,802	15,887	907	4,004	6,444	1,148	280	60,472
South America:								
Argentina	242	121				130	5	498
Brazil	53	955	62	84		559	25	1,738
Chile		14	(4)	102	934	105	32	1,187
Colombia		2			10	64	92	168
Peru		275		(4)		35	30	340
Uruguay		164				44	1	209
Venezuela		1				177	25	203
Other South America		15	1	60		41	21	138
Total	295	1,547	63	246	944	1,155	231	4,481
Europe:								
Belgium-Luxembourg		375	2	189		568	29	1,163
Denmark		477	1	587	169	147	8	1,389
France	487	1,025		352		362	39	2,265
Germany		392		45		100	74	611
Italy		313			1	582	81	977
Portugal		207	33	15		80	14	349
Sweden		1,103	210	675	299	135	17	2,439
Switzerland		89	(4)	181		79	5	354
United Kingdom	424	8,055	174	2,314		1,854	13	12,834
Other Europe	60	678	63	732		1,271	72	2,876
Total	971	12,714	483	5,090	469	5,178	352	25,257

See footnotes at end of table.

TABLE 88.—Crude petroleum and major petroleum products exported from continental United States, in 1949, by countries of destination, and shipments to and exports from noncontiguous Territories, in thousands of barrels [1] [2]—Con.

[U. S. Department of Commerce]

Destination	Crude petroleum	Motor fuel [3]	Kerosine	Distillate oil	Residual oil	Lubricating oil	Wax	Total
Asia:								
China (Formosa)		281				13	(4)	294
Hong Kong		217	(4)			96	40	353
India		3	36	245		1,060	(4)	1,344
Japan		32			301	11	20	364
Philippines		286	33	25	298	209	21	872
Turkey		190	142	9		200	5	546
Other Asia		387	1	35		729	25	1,177
Total		1,396	212	314	599	2,318	111	4,950
Africa:								
Algeria		166				139	4	309
Belgian Congo		99	8	(4)		49	1	157
French Equatorial Africa		58	12	20	5	16	(4)	111
French Morocco		126	22	41	87	125	30	431
French West Africa		130	34	3		54		221
Gold Coast		21	13			25		59
Mozambique		28	6	47		119	1	201
Tunisia		37				54	2	93
Union of South Africa		117	19	103		430	15	684
Other Africa	(4)	115	7	86		447	1	656
Total	(4)	897	121	300	92	1,458	54	2,922
Oceania:								
Australia		1,030	3	(4)		913	2	1,948
New Zealand		342	4	29		145	1	521
Other Oceania		62	28	28		11		129
Total		1,434	35	57		1,069	3	2,598
Grand total	33,068	33,875	1,821	10,011	8,548	12,326	1,031	100,680
Shipments from continental United States to noncontiguous Territories:								
Puerto Rico		1,946	521	177	3	62	(4)	2,709
Virgin Islands		29	8	10		(4)		47
Other		105	9	24		(4)	(4)	138
Total		2,680	538	211	3	62	(4)	2,894
Exports from noncontiguous Territories to foreign countries:								
Alaska		90	(4)	166		2		258
Hawaii		(4)	(4)	(4)		(4)		(4)
Puerto Rico		(4)	(4)	(4)	(4)	(4)		(4)
Total		90	(4)	166	(4)	2		258
Total net shipments from continental United States	33,068	35,865	2,359	10,056	8,551	12,386	1,031	103,316

[1] Compiled by M. B. Price and E. D. Page, oft he Bureau of Mines, from records of the U. S. Department of Commerce.
[2] Changes for table in Minerals Yearbook, 1948, pp. 1018–1020, are as follows: 1948—Motor fuel exported to New Zealand, 408 barrels; total Oceania, 1,286; grand total, 32,700; total net shipments, 35,041. Fuel oil—Canada, 9,380 barrels; total North America, 15,791; grand total, 27,920; total net shipments, 29,594. Lubricating oils—Australia, 599 barrels; New Zealand, 174; total Oceania, 778; grand total, 12,855; net total 12,923.
[3] Includes natural gasoline, naphtha, benzol, and antiknock compounds.
[4] Less than 1,000 barrels.

Outward shipments of kerosine were 28 percent less in 1949 than in 1948. The decreases were general, but were greatest in shipments to North American countries. Only shipments to Africa and to the noncontiguous Territories formed an exception to the general decline.

Exports and territorial shipments of distillate fuel oil decreased 43 percent from 1948 to 1949. The decrease was general but was greatest in exports to Canada and to the United Kingdom. Only shipments to African countries formed an exception to the general decrease.

Outward shipments of residual fuel oil were 3 percent less in 1949 than in 1948. Decreased exports to Canada, Central America and the West Indies, Europe, and China and Hong Kong were nearly balanced by increased shipments to South America, Cuba, Japan, the Philippine Islands, and the noncontiguous territories in particular.

Lubricating-oil exports and shipments decreased 3 percent from 1948 to 1949. The principal decreases were in exports to Europe other than the United Kingdom, to South America, and to India. Increases in exports to other destinations did not suffice to offset the decreases in exports to the destinations named.

WORLD PRODUCTION

For the first time since 1942, the world production of crude petroleum declined; it was 1 percent less in 1949 than in 1948. Curtailments in the United States and Venezuela, the two leading producers, were the chief factors in the decline. For the other major producing countries, petroleum output was larger in 1949 than in 1948.

The Western Hemisphere supplied 78 percent of the total production in 1948 and 73 percent in 1949. The United States alone furnished 59 percent of the world output in 1948 and 54 percent in 1949. Venezuela, the second-largest producing country, supplied 14 percent of the total both in 1948 and in 1949. The Middle East (Bahrein Island, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, Turkey, and Egypt) increased its share from 13 percent in 1948 to 16 percent in 1949.

Petroleum production in the United States decreased 9 percent from 1948 to 1949. Canada, however, as a result of activity in Alberta, had a high proportional increase in the same period—81 percent. Mexico's production was 4 percent larger in 1949 than in 1948. Trinidad produced 3 percent more petroleum in 1949 than in 1948.

TABLE 89.—World production of crude petroleum, by countries, 1943–49,[1] in thousands of barrels

[Compiled by Berenice B. Mitchell]

Country	1943	1944	1945	1946	1947	1948	1949 [1]
North America:							
Barbados	2	1	2	1	([2])	([2])	([2])
Canada	10,052	10,099	8,483	7,586	7,692	12,287	22,220
Cuba [3]	107	109	149	269	[4] 300	[4] 159	[4] 206
Mexico	35,163	38,203	43,547	49,235	56,284	58,508	60,910
Trinidad	21,385	22,139	21,093	20,233	20,521	20,111	20,617
United States	1,505,613	1,677,904	1,713,655	1,733,939	1,856,987	2,020,185	1,840,307
Total North America	1,572,322	1,748,455	1,786,929	1,811,263	1,941,784	2,111,250	1,944,260
South America:							
Argentina	27,714	24,230	22,881	20,604	21,846	23,734	22,961
Bolivia	334	314	382	363	377	464	678
Brazil	48	58	79	67	97	144	109
Colombia	13,261	22,291	22,449	22,118	24,794	23,792	29,722
Ecuador	2,315	2,967	2,664	2,323	2,282	2,563	2,617
Peru	14,654	14,389	13,744	12,468	12,764	14,069	14,790
Venezuela	177,631	257,046	323,156	388,486	434,905	490,015	482,316
Total South America	235,957	321,295	385,355	446,429	497,065	554,781	553,193
Europe:							
Albania	1,001	334	[4] 267	[4] 1,000	[4] 2,000	[4] 1,500	[4] 2,188
Austria	7,478	8,218	3,074	5,734	6,285	6,149	6,100
Czechoslovakia	[4] 200	[4] 185	91	196	210	204	292
France	[4] 356	[4] 300	202	368	356	370	411
Germany	4,973	6,154	3,935	4,539	4,032	4,489	5,947
Hungary	6,347	[5] 6,277	[5] 5,018	5,146	4,330	3,647	3,791
Italy	86	55	53	83	81	71	71
Netherlands [6]	1	11	37	395	1,340	3,122	3,912
Poland	[4] 3,500	[4] 3,000	[7] 750	866	951	[4] 1,039	[4] 965
Rumania	39,182	26,191	34,772	31,434	28,552	[4] 34,000	[4] 33,700
U. S. S. R.[4] [8]	200,750	275,000	148,953	157,673	187,463	218,000	233,000
United Kingdom	839	703	532	412	351	323	368
Yugoslavia	10	307	307	245	365	385	440
Total Europe [8]	264,723	326,735	197,991	208,091	236,316	273,299	291,155
Asia:							
Bahrein Island	6,572	6,714	7,309	8,010	9,411	10,915	10,985
Burma	1,000	[4] 750	[4] 725	15	59	360	316
China	447	505	484	513	374	583	730
Formosa	38	40	14	16	22	23	22
India	2,735	2,734	2,863	2,193	1,863	1,875	1,894
Indonesia	48,294	22,260	7,600	2,100	8,020	[9] 31,900	[9] 44,932
Iran	74,612	102,045	130,526	146,819	154,998	190,384	204,712
Iraq	24,848	30,943	35,112	35,665	35,834	26,115	31,000
Japan	1,727	1,601	1,544	1,343	1,276	1,122	1,353
Kuwait				5,931	16,225	46,500	90,000
Pakistan	([10])	([10])	([10])	([10])	356	490	746
Qatar							750
Sarawak and Brunei	[4] 4,500	[4] 6,000	2,100	2,050	12,970	20,120	25,108
Saudi Arabia	4,868	7,794	21,311	59,944	89,852	142,853	174,008
Turkey							95
U. S. S. R.: Sakhalin [4]	5,000	5,000	6,000	6,000	7,000	7,000	7,000
Total Asia [8]	174,641	186,436	215,088	270,599	338,260	480,190	598,651
Africa:							
Egypt	8,953	9,416	9,406	9,070	8,627	13,398	15,997
French Morocco	39	32	26	20	21	100	136
Total Africa	8,992	9,448	9,432	9,090	8,648	13,498	16,133
Oceania:							
Australia (Victoria)						1	1
New Zealand	2	2	3	2	2	2	7
Total Oceania	2	2	3	2	2	3	8
Grand total	2,256,637	2,592,371	2,594,798	2,745,474	3,022,075	3,433,021	3,398,400

[1] Preliminary figures.
[2] Less than 500 barrels.
[3] Natural naphtha and gas oil.
[4] Estimate.
[5] Data represents Trianon Hungary after October 1944.
[6] Data revised in accordance with recent information stating 6.3 barrels per metric ton.
[7] Beginning in 1945, postwar borders.
[8] U. S. S. R. in Asia (except Sakhalin) included with U. S. S. R. in Europe.
[9] Includes New Guinea whose production amounted to 1,725,500 barrels in 1949.
[10] Included with India.

Crude-petroleum production in western Europe continued to increase. In Germany increased yields in Emsland and other new fields compensated for declines in the output of the older salt-dome fields. In the Netherlands, drilling enlarged the boundaries of the Schoonebeek field and increased the petroleum production of the country. In Austria the new Matzen field made up for declines in the older fields, so that the petroleum production of the country was little changed from 1948 to 1949.

For eastern Europe exact statistics are generally lacking. The U. S. S. R. apparently increased its production 7 percent from 1948 to 1949. Both Poland and Rumania are estimated to have had lower production in 1949 than in 1948.

The most spectacular gains in petroleum production were in the Middle East. Saudi Arabia produced 22 percent more petroleum in 1949 than in 1948. Two new fields were discovered. Kuwait nearly doubled its output from 1948 to 1949 by virtue of increased exports to France, the United States, and the United Kingdom. A new 20,000-barrel refinery began operations in December 1949. The opening of an additional pipeline from Kirkuk to Tripoli, Lebanon, permitted crude output in Iraq to increase 19 percent from 1948 to 1949. In Egypt, new fields on the Sinai Peninsula increased petroleum production 19 percent from 1948 to 1949. However, Iran, largest producer of the Middle East, had a smaller proportional increase of 7 percent; greater output from the Agha Jari field offset declines in the older fields of Masjid-i-Suleiman, Haft Kel, and Gach Saran.

Eastern Asia continued its recovery from war damages and political unrest. Reconstruction and political settlement in the United States of Indonesia and the beginning of commercial production in New Guinea raised the petroleum production of the islands 41 percent from 1948 to 1949. In British Borneo the 1949 output was 25 percent larger than in 1948 and three and one-half times that of 1939.

Phosphate Rock

By Bertrand L. Johnson and E. M. Tucker

GENERAL SUMMARY

MINED production of phosphate rock in the United States in 1949 dropped from the record high of 1948 (9,388,160 long tons) to 8,877,474 tons, according to reports submitted by producers to the Bureau of Mines, a decline of over half a million tons. Decreases were shown in Florida and Tennessee, whereas there was a considerable increase in the mined production of western rock, which, however, did not approach the 1947 record high. Supplies of phosphate rock were plentiful and adequate to meet demands.

In contradistinction to the trend in the mined production, that of the sold or used phosphate rock turned slightly upward, from 8,668,769 long tons in 1948 to 8,986,933 tons in 1949. (See fig. 1.) Decreased

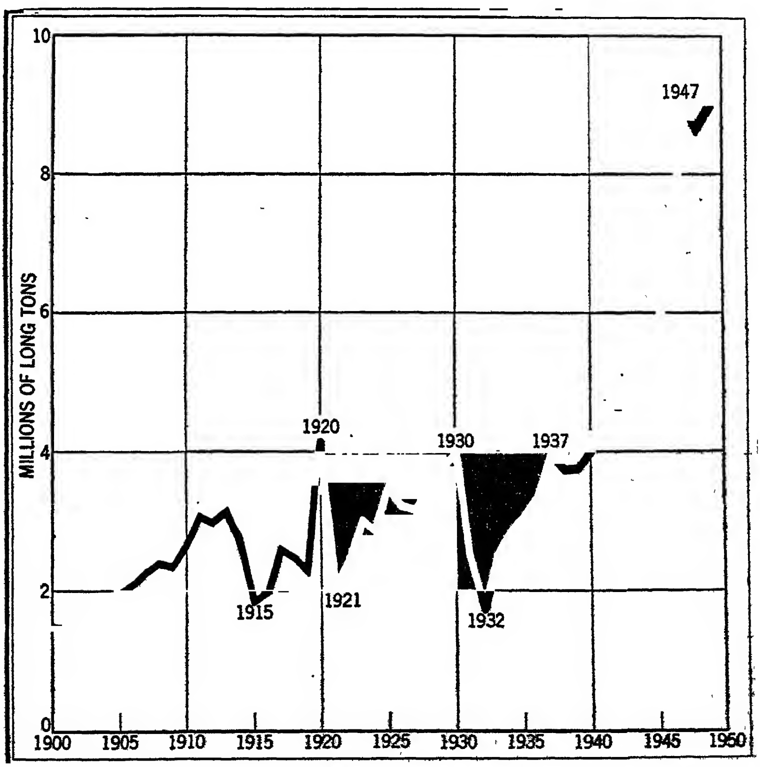

FIGURE 1.—Marketed production of domestic phosphate rock, 1900–49.

sales of Idaho and Wyoming phosphate rock were more than compensated by increases of Florida, Tennessee, and Montana rock. The total value of the phosphate rock sold or used in 1949 rose to $51,415,027, slightly over $900,000 above the 1948 level. The P_2O_5 content of the rock sold or used in 1949 increased to 2,913,796 long tons from 2,810,206 in 1948. This was a new record high, nearly 11,000 tons above the previous record of 1947 (2,903,082 tons). Imports increased both in quantity and value in 1949. Exports in 1949, as reported by producers, were likewise above those in 1948 in both categories. Apparent domestic consumption increased slightly in 1949, to 7,735,005 long tons. Stocks at the end of 1949 had declined sharply, principally in Florida.

Salient statistics of the phosphate-rock industry in the United States, 1948–49

	1948				1949			
	Long tons		Value at mines		Long tons		Value at mines	
	Rock	P_2O_5 content	Total	Average	Rock	P_2O_5 content	Total	Average
Production (mined)	9,388,160	3,035,108	(1)	(1)	8,877,474	2,866,897	(1)	(1)
Sold or used by producers:								
Florida:								
Land pebble	6,421,725	2,155,037	$37,070,381	$5.77	6,715,097	2,265,780	$37,339,985	$5.56
Soft rock	69,335	13,992	293,927	4.24	77,088	15,652	344,787	4.47
Hard rock	48,198	17,404	368,586	7.65	23,804	8,522	173,211	7.28
Total Florida	6,539,258	2,186,433	37,732,894	5.77	6,815,989	2,289,954	37,857,983	5.55
Tennessee [2]	1,307,507	369,612	8,231,251	6.30	1,344,470	377,081	9,067,589	6.74
Idaho [3]	434,375	131,284	2,122,089	4.89	471,305	133,794	1,915,125	4.06
Montana	248,683	78,421	1,720,254	6.92	355,169	112,967	2,574,330	7.25
Wyoming	138,946	44,456	695,110	5.00	(3)	(3)	(3)	(3)
Total United States	8,668,769	2,810,206	50,501,598	5.83	8,986,933	2,913,796	51,415,027	5.72
Imports	48,104	(1)	608,932	12.66	64,891	(1)	821,842	12.66
Exports [4]	1,016,792	(1)	6,144,298	6.04	1,316,819	(1)	8,005,521	6.08
Apparent consumption	7,700,081	(1)			7,735,005	(1)		
Stocks in producers' hands Dec. 31:								
Florida	1,145,000	376,000	(1)	(1)	873,000	292,000	(1)	(1)
Tennessee	582,000	159,000	(1)	(1)	494,000	137,000	(1)	(1)
Western States	92,000	28,000	(1)	(1)	31,000	10,000	(1)	(1)
Total stocks	1,819,000	563,000	(1)	(1)	1,398,000	439,000	(1)	(1)

[1] Data not available.
[2] Tennessee includes a small quantity from Virginia in 1949.
[3] Idaho includes Utah in 1948 and Wyoming in 1949.
[4] Exports as reported by producers to Bureau of Mines.

Several general papers relating to the phosphate-rock industry[1] have appeared recently.

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[1] Partridge, E. P., Some Suggestions Concerning Nomenclature: Chem. and Eng. News, vol. 27, No. 4, Jan. 24, 1949, pp. 214–217.
Johnson, Bertrand L., Phosphate-Rock Industry of Eastern United States: Min. Cong. Jour., vol. 36, No. 2, February 1950, pp. 119–120.
Barr, J. A., Phosphate Rock: Engineering and Mining Journal, vol. 151, No. 2, February 1950, pp. 103–104.
Federal Trade Commission. Report on Fertilizer Industry. Submitted to the Congress Jan. 5, 1950.
Perlow, [illegible], Phosphorus, Elemental: U. S. Department of Commerce, Office of Domestic Commerce, Chemicals and Drugs, November 1949, pp. 49–54.
Stenerson, Harry, Behind the Markets: Chem. and Eng. News, vol. 27, No. 9, Dec. 5, 1949, p. 3666.

PRODUCTION

Mined production of phosphate rock in the United States in 1949 (8,877,474 long tons) declined over 500,000 tons from the record high of 1948 (9,388,160 tons).

Phosphate rock mined in the United States, 1940–49, by States, in long tons

Year	Florida	Tennessee [1]	Western States	United States	Year	Florida	Tennessee [1]	Western States	United States
1940	2,782,956	1,120,551	164,570	4,068,077	1945	3,814,935	1,260,849	323,955	5,399,739
1941	3,417,900	1,301,067	203,216	4,922,183	1946	5,280,402	1,316,107	572,330	7,168,839
1942	2,984,503	1,568,162	266,273	4,818,938	1947	6,381,282	1,489,980	1,239,727	9,110,989
1943	3,274,266	1,868,407	227,294	5,369,967	1948	7,184,297	1,499,547	704,316	9,388,160
1944	3,486,482	1,413,246	300,274	5,200,002	1949	6,695,407	1,403,469	778,598	8,877,474

[1] Includes small quantity of apatite from Virginia in 1940–47, and in 1940–43 some matrix of washer grade.

SALES

A considerable increase in the quantity of phosphate rock sold or used by domestic producers brought the total for the United States in 1949 to 8,986,933 long tons.

Phosphate rock sold or used by producers in the United States, 1945–49

Year	Long tons	Value at mines: Total	Value at mines: Average	Year	Long tons	Value at mines: Total	Value at mines: Average
1945	5,806,723	$23,951,077	$4.12	1948	8,668,769	$50,501,598	$5.83
1946	6,860,713	31,043,821	4.52	1949	8,986,933	51,415,027	5.72
1947	9,027,030	46,638,837	5.17				

Phosphate rock sold or used by producers in the United States in 1945–48, by States, and in 1949, by grades and States

Grades—B. P. L.[1] content (percent)	Florida: Long tons	Florida: Percent of total	Tennessee [2]: Long tons	Tennessee [2]: Percent of total	Western States: Long tons	Western States: Percent of total	Total United States: Long tons	Total United States: Percent of total
1945	4,238,228	100	1,294,297	100	274,198	100	5,806,723	100
1946	5,005,511	100	1,362,600	100	492,602	100	6,860,713	100
1947	6,482,027	100	1,411,884	100	1,133,119	100	9,027,030	100
1948	6,539,258	100	1,307,507	100	822,004	100	8,668,769	100
1949								
Below 60	82,420	1	556,024	41	163,365	20	801,809	9
60 to 66	32,013	(3)	305,172	23	38,362	4	375,547	4
68 basis, 66 minimum	254,810	4	341,819	26	332,010	40	928,639	10
70 minimum	1,062,628	16	138,570	10	252,876	31	1,454,074	16
72 minimum	1,254,545	18			39,861	5	1,294,406	15
75 basis, 74 minimum	2,706,992	40	667	(3)			2,707,659	30
77 basis, 76 minimum	1,422,581	21					1,422,581	16
Above 85 (apatite) / Undistributed			2,218	(3)			2,218	(3)
Total	6,815,989	100	1,344,470	100	826,474	100	8,986,933	100

[1] Bone phosphate of lime, $Ca_3(PO_4)_2$.
[2] Includes a small quantity from Virginia in 1945–47 and in 1949.
[3] Less than 0.5 percent.

CONSUMPTION AND USES

The apparent consumption of phosphate rock in the United States in 1949 increased to 7,735,005 long tons from 7,700,081 tons in 1948, an increase of nearly 35,000 tons.

Apparent consumption [1] of phosphate rock in the United States, 1945–49, in long tons

Year	Long tons	Year	Long tons
1945	5,457,648	1948	7,700,081
1946	6,221,525	1949	7,735,005
1947	7,425,784		

[1] Quantity sold or used by producers plus imports minus exports.

Data regarding the sales of phosphate rock by uses are shown in the accompanying tables.

Phosphate rock sold or used by producers in the United States, 1947–49, by uses

Uses	1947		1948		1949	
	Long tons	Percent of total	Long tons	Percent of total	Long tons	Percent of total
Domestic:						
Superphosphates	5,367,666	60	5,664,938	65	5,598,423	62
Phosphates, phosphoric acid, phosphorus, ferrophosphorus	1,134,608	13	1,087,883	13	1,254,615	14
Direct application to soil	764,125	9	791,827	9	732,695	8
Fertilizer filler	37,633	(1)	30,902	(1)	18,815	(1)
Stock and poultry feed	40,228	(1)	40,510	1	62,236	1
Undistributed [2]	38,047	(1)	35,917	(1)	3,330	(1)
Exports [3]	1,644,723	18	1,016,792	12	1,316,819	15
Total	9,027,030	100	8,668,769	100	8,986,933	100

[1] Less than 0.5 percent.
[2] Includes phosphate rock used in pig-iron blast furnaces, parting compounds, research, defluorinated phosphate rock, refractories, and other uses.
[3] As reported to the Bureau of Mines by domestic producers.

Certain details regarding the domestic superphosphate industry are shown in the following table.

Production, shipments, and stocks of superphosphates (18 percent available phosphoric acid), 1945–49, in short tons

[Bureau of the Census]

	1945	1946	1947	1948	1949
Production	7,372,104	7,847,591	9,292,677	9,319,697	9,075,903
Shipments	4,332,992	4,421,670	4,752,324	4,789,668	4,845,175
Stocks in manufacturers' hands Dec. 31	808,027	646,278	856,382	1,216,788	1,139,372

Phosphate rock sold or used by producers in the United States, by uses and States, 1938–49, in long tons

State and use	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
Florida:												
Superphosphates	1,470,975	1,579,924	1,917,319	2,177,629	2,451,004	3,010,701	3,138,307	3,387,641	3,959,108	4,842,304	5,117,520	4,965,060
Phosphates, phosphoric acid, phosphorus, ferrophosphorus	134,148	124,823	161,160	174,478	111,095	197,888	202,487	209,176	231,338	327,151	316,658	342,282
Direct application to the soil	36,649	35,484	39,083	48,404	45,078	51,838	84,938	213,560	314,575	485,517	513,495	522,310
Fertilizer filler	19,063	25,175	25,838	24,377	24,725	19,805	13,640	9,813	32,303	18,006	19,323	6,269
Stock and poultry feed	4,427	761	558	2,572	6,095	57,357	31,573	61,551	52,501	36,496	40,510	56,703
Undistributed	6,087	8,674	2,972	4,152	1,294	397	15,192		1,047		99	
Exports	1,035,986	903,943	698,082	933,960	372,949	250,507	266,658	356,487	414,639	772,553	531,653	923,365
Total Florida	2,707,335	2,678,784	2,845,012	3,365,572	3,012,240	3,588,493	3,752,795	4,238,228	5,005,511	6,482,027	6,539,258	6,815,989
Tennessee:												
Superphosphates	539,062	516,844	545,687	548,829	682,024	500,664	435,051	424,750	[1] 449,496	[1] 275,488	231,654	378,760
Phosphates, phosphoric acid, phosphorus, ferrophosphorus	[1] 307,152	[1] 353,427	[1] 370,927	[1] 469,131	[1] 535,150	[1] 643,578	[1] 679,496	649,037	653,885	799,422	761,698	735,309
Direct application to the soil	44,985	59,576	66,593	94,195	137,782	139,562	170,008	196,228	212,405	278,280	270,899	208,829
Fertilizer filler	5,683	5,819	6,966	7,004	5,391	7,703	5,332	4,680	18,454	19,627	11,579	12,546
Stock and poultry feed	1,477	1,033	753	1,199	2,320	[1] 9,602	[1] 24,244	1,974	500	3,732		5,533
Undistributed	939	1,749	3,435		3,668	7,950	[1] 10,718	[1] 17,628	27,860	35,335	31,677	1,275
Exports	[2] 100											2,218
Total Tennessee[1]	899,398	938,448	994,361	1,120,358	1,366,335	1,309,059	1,324,849	1,294,297	1,362,600	1,411,884	1,307,507	1,344,470
Western States:												
Superphosphates	64,742	96,011	101,838	98,998	109,661	120,421	107,916	133,876	195,838	249,874	315,764	254,603
Phosphates, phosphoric acid, phosphorus, ferrophosphorus	1,786	770	893	1,339	3,571	4,839	8,650	5,388	9,278	8,035	9,527	177,024
Direct application to the soil	1,435	607	616	597	1,373	2,531	1,790	1,855	1,117	328	7,433	1,556
Fertilizer filler						182	36					
Stock and poultry feed					51	329	127					
Undistributed	722		340	1,340	1,184		2,022		2,081	2,712	4,141	2,055
Exports	63,820	42,447	59,640	101,448	149,825	100,378	178,458	133,079	284,288	872,170	485,139	391,236
Total Western States	132,505	139,835	163,327	203,722	265,665	228,680	298,999	274,198	492,602	1,133,119	822,004	826,474
Total United States	3,739,238	3,757,067	4,002,700	4,689,652	4,644,240	5,126,232	5,376,643	5,806,723	6,860,713	9,027,030	8,668,769	8,986,933

[1] Includes Virginia. [2] Includes South Carolina.

PRICES

Prices for Florida land-pebble phosphate rock and for Tennessee brown-rock phosphate moved in opposite directions in 1949. A decline in Florida prices occurred early in the year following a downward revision in the price of fuel oil at Tampa, Fla. In the fall of 1949, fuel-oil prices were raised, and the price of the Florida land pebble advanced slightly, but not to the levels prevailing in the early months of the year. Tennessee price advanced early in the year and retained the new level for the remaining months. The advance was attributed to an increased price for coal. The accompanying table gives the price quotations of Oil, Paint and Drug Reporter at the beginning, middle, and end of 1949 for Florida and Tennessee phosphate rock. Tennessee quotations are now given on a P_2O_5 basis, instead of the B. P. L. content formerly used. Quotations for Western States phosphate rock are not given in the trade journals.

Prices per long ton of Florida and Tennessee unground, washed, and dried phosphate rock, in bulk, f. o. b. cars at mine, by grades, in 1949–50

[Oil, Paint and Drug Reporter]

Grades (percent)[1]	Florida land pebble			Tennessee brown rock		
	Jan. 3, 1949	July 4, 1949	Jan. 2, 1950	Jan. 3, 1949	July 4, 1949	Jan. 2, 1950
68/66 B. P. L	$4.61	$3.60	$3.75			
70/68 B. P. L	5.01	4.00	4.155			
72/70 B. P. L	$5.31–5.61	$4.60–4.80	4.805			
75/74 B. P. L	6.31–6.51	5.60–5.80	5.805			
77/76 B. P. L	7.31	6.60–6.80	6.905			
27–26 P_2O_5				$6.00	$6.45	$6.45
30–29 P_2O_5				6.75	7.21	7.21

[1] B. P. L. signifies bone phosphate of lime, $Ca_3(PO_4)_2$.

REVIEW BY STATES

SOUTHERN STATES

Florida.—The upward trend in the marketed production of Florida phosphate rock continued in 1949. A new high record of 6,815,989 long tons valued at $37,857,983 was made. The greater part of the production came from the land-pebble field, relatively small quantities of hard rock and soft rock (waste-pond phosphates from the hard-rock field) being produced. The production of the latter kind much exceeded that of the hard rock.

The land-pebble phosphate-rock companies mining and shipping phosphate rock in 1949 were the American Agricultural Chemical Co. (Pierce); American Cyanamid Co. (Brewster); Coronet Phosphate Co. (Plant City); Davison Chemical Corp. (Ridgewood); International Minerals & Chemical Corp. (Mulberry); Swift & Co. (Agricola); and the Virginia-Carolina Chemical Corp. (Nichols). The Pembroke Chemical Corp. (Pembroke) did no mining in 1949 but made some shipments. The Armour Fertilizer Works was not yet in production.

The American Agricultural Chemical Corp. operated its No. 3, 11, and 12 mines and washers, its tabling plant, and its drier at Pierce. The American Cyanamid Co. reports that phosphate rock was recovered from its Saddle Creek and Sidney mines and washers and dried

Florida phosphate rock sold or used by producers, 1945–49, by kinds

Year	Hard rock			Soft rock [1]		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1945	63, 401	$426, 061	$6. 71	71, 715	$293, 433	$4. 09
1946	100, 881	762, 127	7. 55	97, 067	387, 708	3. 99
1947	79, 330	618, 330	7. 79	88, 620	326, 064	3. 68
1948	48, 198	368, 586	7. 65	69, 335	293, 927	4. 24
1949	23, 804	173, 211	7. 28	77, 088	344, 787	4. 47

Year	Land pebble			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1945	4, 103, 022	$15, 578, 980	$3. 80	4, 238, 228	$16, 298, 474	$3. 85
1946	4, 807, 563	19, 867, 339	4. 13	5, 005, 511	21, 017, 174	4. 20
1947	6, 314, 077	31, 975, 858	5. 06	6, 482, 027	32, 920, 252	5. 08
1948	6, 421, 725	37, 070, 381	5. 77	6, 539, 258	37, 732, 894	5. 77
1949	6, 715, 097	37, 339, 985	5. 56	6, 815, 989	37, 857, 983	5. 55

[1] Includes material from waste-pond operations.

at its Brewster drier. A new flotation plant was started by this company at Sidney, between Mulberry and Tampa. The Coronet Phosphate Co. operated its Eleanor mine, washer, and flotation unit, drying the phosphate rock produced at its Coronet drier.

The Davison Chemical Corp. operated its Bonny Lake and Pauway No. 4 mines and washers and dried the washed rock at its Ridgewood drying plant. In January 1949 the Davison Co. placed a new phosphate flotation plant in operation south of Lakeland, Fla. This plant [2] is an addition to the Pauway No. 4 washer and table plant that processes the material from its No. 4 mine.

The International Minerals & Chemical Corp. operated its Noralyn, Peace Valley, and Achan mines and washers and its Noralyn and Prairie driers in 1949. The Achan mine and washer were in operation only during the last 5 months of the year. During the fiscal year ended June 30, 1949, new drying, storage, and shipping facilities were installed at the Noralyn mine. One drying unit measured 8 by 80 feet. The tonnage shipped by the company in March 1949 was the highest for any month in its history. A strike in May and June 1949 stopped all operations of the company for 7 weeks.

Swift & Co. operated its Swift No. 5 and Swift No. 6 mines and washers, drying the phosphate rock produced at its Agricola drying plant. Triple superphosphate is reported as produced at its new Agricola facilities. The Virginia-Carolina Chemical Corp. operated its Homine mine and washer and mined feed from the Phosmico debris dumps. Most of the phosphate rock recovered was dried at the Phosmico and Nichols drying plants. Some was calcined.

[2] Sauchelli, Vincent, Davison's Pauway Plant Uses New Techniques: Commercial Fertilizer, vol. 79, No. 2, August 1949, pp. 20–22.
Lenhart, W. B., High Phosphate Recovery Through Use of Froth Flotation: Rock Products, vol. 52, No. 8, August 1949, pp. 105–108, 130.

The Pembroke Chemical Corp. reports that it did no mining in 1949 but shipped several thousand tons of phosphate rock from stock. Some purchased rock was exported for its account. The Armour Fertilizer Works report that there were no phosphate-mining operations or shipments at its Florida plant. Its new triple superphosphate plant near Bartow is now in operation, using dry-ground Florida phosphate rock and sulfuric acid to make, first, phosphoric acid, and then, the triple superphosphate.

Uranium has been detected in the marine land-pebble phosphate-rock deposits of Florida. The deposits have been under investigation since 1947 by the United States Geological Survey and the Atomic Energy Commission. Whether the uranium deposits are of economic importance has not been disclosed.

In the hard-rock phosphate field, C. & J. Camp (P. O. Box 608, Ocala, Fla.) and J. Buttgenbach & Co. (P. O. Box 67, Lakeland, Fla.), who had operated the Section 12 mine near Dunnellon jointly in recent years, were succeeded on January 1, 1949, by the Kibler-Camp Phosphate Enterprise (P. O. Box 608, Ocala, Fla.), now the only hard-rock phosphate operator in Florida. Operations were continued at the Section 12 mine, and shipments were made both for domestic consumption and for export.

The processing plant of the Fernandina (Fla.) Phosphate Corp. at Fernandina used in the past for drying and crushing hard-rock phosphate for loading on ships for export was shut down early in 1949, although vessels called thereafter to load the remainder of the stocks. The company is reported to have announced on July 5 that it could see "no more future in the export of phosphate through Fernandina."

Several soft-rock phosphate mining companies were in operation in 1949, mining the fine-grained phosphatic residues in the old waste-pond dumps near Dunnellon, Hernando, and Clark, in the hard-rock-phosphate field. Part of this material was sold for use as a phosphate fertilizer for direct application to the soil, part for use as a filler in commercial mixed or complete fertilizers, and part for stock and poultry feed. No production or shipments are reported from the phosphatic clay operation at Bartow in the land-pebble phosphate-rock area, and this company is stated to be no longer in operation.

Several general papers on the phosphate-rock industry of Florida have appeared recently.[3]

South Carolina.—No production of phosphate rock came from the deposits in South Carolina in 1949. One of the major domestic phosphate-rock-mining companies—the Virginia-Carolina Chemical Corp.—began erection of an electric furnace for producing elemental phosphorus north of Charleston, S. C., in 1949. The dedication ceremony was held at the site on October 18, 1949. Phosphate rock for the furnace will be hauled by rail from the company mines in the Florida land-pebble field.[4] The furnace is situated on the site of the first commercial phosphoric acid plant in the United States using the

[3] American Institute of Mining and Metallurgical Engineers, Florida Phosphate Highlights IMD Program: December 1949, pp. 45–46.
Feeley, J. C., Jr., Prospect Drilling for Phosphates in Florida: Bureau of Mines Inf. Circ. 7500, 1949, 15 pp.
Hunter, F. R., Occurrence of Heavy Minerals in the Pebble Phosphate Deposits of Florida: Am. Inst. Min. and Met. Eng., Min. Technol., vol. 12, No. 5, September 1948, Technical Paper 2456, 4 pp.
Federal Trade Commission, Report on the Fertilizer Industry; Submitted to Congress January 9, 1950: Washington, D. C., 1950, 176 pp.

[4] V-C News, V-C Phosphorus Furnace Rises on Historic Charleston Site: Vol. 3, No. 3, November 1949, pp. 6–8.

"wet process." This was erected and operated by the Virginia-Carolina Chemical Corp. in 1907.

Tennessee.—Tennessee retains its position as the second-largest phosphate-rock-producing State. In 1949 the quantity of phosphate rock sold or used by Tennessee producers was nearly 40,000 long tons (36,963 tons) greater than in 1948, rising from 1,307,507 long tons in that year to 1,344,470 tons in 1949. The total value in 1949 increased $836,338 over 1948, according to reports from producing companies, and rose to $9,067,589.

Tennessee brown-rock phosphate-mining operations in 1949 were carried on by the Tennessee Valley Authority (Columbia, Tenn.) and by several private companies: Armour Fertilizer Works (Room 350, Hurt Bldg., Atlanta, Ga.); Federal Chemical Co. (634 Starks Bldg., Louisville, Ky.); Harsh Phosphate Co. (Route 1, Murfreesboro Road, Nashville, Tenn.); Hoover & Mason Phosphate Co. (8 Michigan Ave., Chicago, Ill.); International Minerals & Chemical Corp. (20 North Wacker Dr., Chicago, Ill.); Monsanto Chemical Co. (1700 South 2d St., St. Louis, Mo.); Owens Agricultural Co. (Centerville, Tenn.); and Virginia-Carolina Chemical Corp. (P. O. Box 1797, Richmond 14, Va.).

Tennessee phosphate rock [1] sold or used by producers, 1945–49

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1945	1,294,297	$6,062,688	$4.68	1948	1,307,507	$8,231,251	$6.30
1946	1,362,690	7,014,490	5.15	1949	1,344,470	9,067,589	6.74
1947	1,411,884	7,779,099	5.51				

[1] Includes small quantity of Tennessee blue rock in 1945–47 and Virginia apatite in 1945–47 and 1949.

The Tennessee Valley Authority continued its mining and phosphate-processing activities in Tennessee and its technologic operations at its chemical plant at Muscle Shoals in 1949.

According to the annual report of the TVA for the fiscal year ended June 30, 1949, the TVA chemical plant at Muscle Shoals produced more than 158,700 tons of concentrated superphosphate, an increase of 4 percent from the previous fiscal year. More than 36,600 tons of dicalcium phosphate and 3,500 tons of calcium metaphosphate were also produced. Production of fused tricalcium phosphate in the plants at Columbia, Tenn., amounted to 15,200 tons.

During the year TVA began work on application to phosphate ores from Florida and the Western States of two methods of preparing materials for furnace charges developed with Tennessee phosphate sands and matrix. One method is pelletizing, in which the sands are tumbled in a kiln with clay or matrix to form pellets. A new large-scale pelletizing shaft-kiln plant was being designed to demonstrate the process. New large-scale briquetting equipment, which will press the material into lumps, was under construction.

TVA was also designing a large-scale rotating electric furnace, based upon data obtained in pilot-plant operations in the 1948 fiscal year, which indicated that the slowly rotating furnace could, to a considerable extent, use phosphate sands without pelletizing, briquetting, or other agglomeration; that it used less power than the conven-

tional furnace; and that more even distribution of heat reduced wear on the furnace lining.

A satisfactory catalyst and corrosion-resistant construction material for use in a previously known process for making phosphoric acid suitable for fertilizer manufacture by the catalytic oxidation of phosphorus with steam was found in small pilot-plant operations. This process also produces hydrogen as a byproduct; hence it is expected to have special value in areas, such as the western phosphate fields, where ammonia-synthesis facilities can be built in conjunction with electric furnace phosphorus production, particularly where natural gas is not available as a raw material for nitrogenous fertilizers.

TVA also practically completed a new calcium metaphosphate furnace unit in which unagglomerated fine phosphate may be used for a large part of the charge, thus reducing the cost and improving the chemical control of the product.

A plant-scale demonstration unit for recovering fluorine was placed in operation at the fused tricalcium phosphate plant toward the end of the year. The process, in which waste gases from the furnaces are passed through a tower packed with lump limestone, was tested in pilot-plant operation last year. The fluorine is recovered as calcium fluoride, which promises to be a salable byproduct in view of the expanded demand for fluorine compounds.

TVA also completed pilot-plant studies on defluorination of Florida and western-rock phosphate.

Pilot-plant studies during the year produced dicalcium nitraphosphate, containing typically 17 percent nitrogen and 23 percent P_2O_5. A similar project using sulfuric instead of phosphoric acid was tried in pilot-plant operations, producing material containing about 14 percent each of nitrogen and phosphate. A process in which rock-phosphate is treated with nitric acid and the product ammoniated was studied also.

A report dealing with the TVA's fertilizer production research, including laboratory investigations, pilot-plant operation, and full-scale demonstration-plant production, was issued during the year.[5]

The Victor Chemical Works, Chicago, Ill., continued production of elemental phosphorus at its electric furnace plant at Mount Pleasant, in the Tennessee brown-rock phosphate field. In 1949 this company acquired the A. R. Maas Chemical Co., South Gate, Calif., which was founded in 1919 by A. R. Maas to manufacture photographic chemicals, phosphoric acid, and sodium phosphates. The Victor Chemical Works also operates phosphorus furnaces at Victor, Fla., and processing plants at Chicago Heights, Ill., Nashville, Tenn., and Morrisville, Pa.

The International Minerals & Chemical Corp. installed new drying and grinding facilities at the Wales plant during the fiscal year ended June 30, 1949, with resultant improved efficiency and lowered costs. The acquisition of additional reserves has lengthened the life of the Wales mine and postponed the opening of a new Hickman County mine. The company output from its Tennessee mines was reported sold as raw material for electric furnace operations and as finely ground phosphate rock for direct application to the soil.

[5] Tennessee Valley Authority, Soil, People, and Fertilizer Technology: Washington, D. C., 1949, 57 pp.

Virginia.—No apatite was produced in 1949 by the Calco Chemical Division of the American Cyanamid Co. at its Piney River, Va., property. However, some shipments of apatite for export were made from stock. The apatite-recovery portion of the plant was not operated in 1948 or in 1949, and the shut-down of this unit is reported permanent by the company. Mining operations continued on the nelsonite (apatite-ilmenite) deposit. The annual output of the crude ore is reported as about 170,000 tons.[6]

WESTERN STATES

Total marketed production of Western States phosphate rock rose slightly in 1949, according to reports from producers to the Bureau of Mines. Increases in Montana counterbalanced declines in Idaho and Wyoming. (See fig. 2.) The total value fell, an increase of $854,076 in the value of the sales of Montana phosphate rock being insufficient to make up for declines in the value of the sales of the other States. Phosphate rock was produced in 1949 in all four States of the western field—Idaho, Montana, Utah, and Wyoming. There were no shipments, however, from Utah.

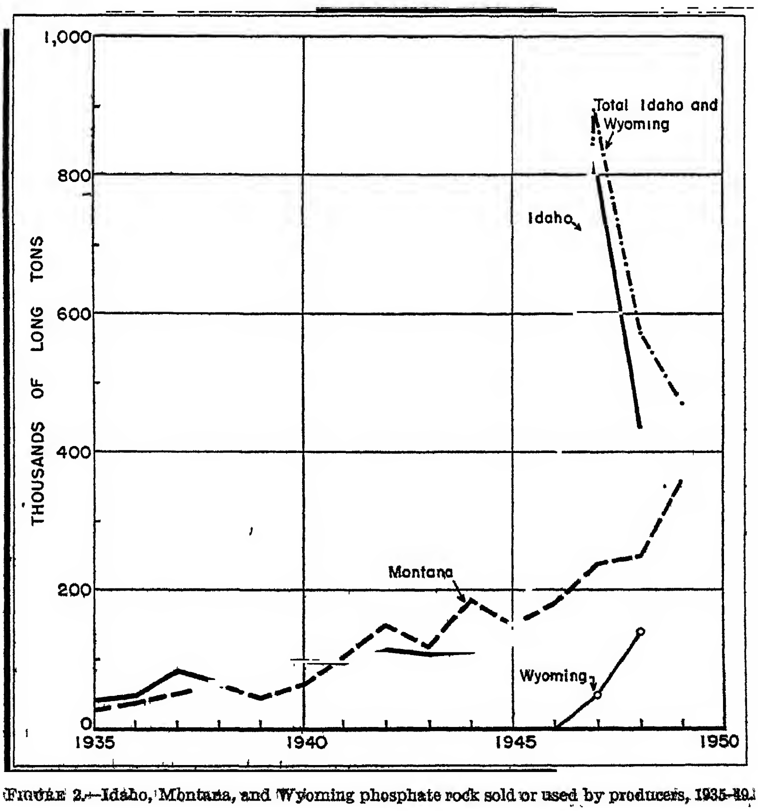

FIGURE 2.—Idaho, Montana, and Wyoming phosphate rock sold or used by producers, 1935–49.

[6] Engineering and Mining Journal, Piney River Operations: Vol. 150, No. 7, July 1949, p. 123.

New regulations doubling the maximum acreage of public lands that might be leased for exploration, development, and production of phosphate rock were announced by the United States Department of the Interior early in 1949. These new regulations authorize long-term leases which have no terminal date but can be revised at the end of 20 years. Two types of leases are provided—noncompetitive leases to promote the discovery of deposits of phosphate rock in unexplored areas and competitive leases for development of areas known to contain commercial phosphate deposits or in which there is competition. Minimum royalties are raised from 2 to 5 percent; rents and royalties are to be paid out of resulting production. The leases are subject to cancellation if phosphate rock is not discovered within 3 years or if production is not begun by the fourth year after issuance.

Several general articles on the phosphate-rock industry of the Western States appeared recently.[7]

Western States phosphate rock sold or used by producers, 1945–49

Year	Idaho [1]			Montana		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1945	123, 340	$673, 627	$5.46	150, 858	$916, 288	$6.07
1946	312, 658	1, 805, 103	5.77	179, 944	1, 207, 054	6.71
1947	845, 045	4, 077, 885	4.83	236, 229	1, 571, 117	6.65
1948	434, 375	2, 122, 089	4.89	248, 683	1, 720, 254	6.92
1949	471, 305	1, 915, 125	4.06	355, 169	2, 574, 330	7.25

Year	Wyoming			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1945				274, 198	$1, 589, 915	$5.80
1946				492, 602	3, 012, 157	6.11
1947	51, 845	$290, 484	$5.60	1, 133, 119	5, 939, 486	5.24
1948	138, 946	695, 110	5.00	822, 004	4, 537, 453	5.52
1949	(1)	(1)	(1)	826, 474	4, 489, 455	5.43

[1] Idaho includes Utah in 1946–48 and Wyoming in 1949.

[7] Jenkins, O. P., Phosphates: California Division of Mines, Mineral Information Service, vol. 2, No. 1, January 1, 1949.
Thomas, C. S., Rock Phosphate Mining, Rocky Mountain Region: Colorado Mining Assoc., 1949 Mining Yearbook, 1949, pp. 53–55.
McHugh, G. A., Western Phosphate: Min. Cong. Jour., vol. 36, No. 2, February 1950, pp. 120–122.
Mining Engineering, Western Phosphate Described: Vol. 1, No. 4, sec. 1, April 1949, p. 28.
Barr, J. A., Phosphate Rock: Eng. and Min. Jour., vol. 151, No. 2, February 1950, pp. 103–105.
McKelvey, V. E., Geological Studies of the Western Phosphate Field: Am. Inst. Min. and Met. Eng., Min. Trans., vol. 184, August 1949, pp. 269–279.
Engineering and Mining Journal, Western Phosphate Output Soars: Vol. 150, No. 7, July 1949, pp. 130–133.
Bartell, A. O., The Fertilizer Industry in the Pacific Northwest: Raw Materials Survey, Portland, Oreg., 16 pp.
Waggaman, W. H., and Bell, R. E., Western Phosphates; Factors Affecting Development: Ind. Eng. Chem., vol. 42, February 1950, pp. 269–276.
Waggaman, W. H., and Bell, R. E., Western Phosphates; Comparison of Sulfuric Acid and Thermal Reduction Processing: Ind. Eng. Chem., vol. 42, February 1950, pp. 276–286.
Bell, R. E., Western Phosphates; Potential Markets: Ind. Eng. Chem., vol. 42, February 1950, pp. 286–292.
Bell, R. E., Economic Factors in the Western Phosphate Industry: Am. Inst. Min. and Met. Eng., Min. Eng., vol. 187, April 1950, pp. 486–490.

Idaho.—Idaho retained its position as the leading phosphate-rock producer of the Western States in 1949; but its output, both in quantity and value, suffered sharp drops from those of 1948. Shipments were greater than for any year except 1947 and 1948. Totals for the State, however, cannot be given without disclosing the production of individual companies. General descriptions of Idaho phosphate-rock deposits and mines are given in several papers published in 1949.[8]

Only two companies were reported producing in Idaho in 1949. The larger producer was again the Simplot Fertilizer Co., Pocatello, Idaho, which continued its open-pit mining operations on the Fort Hall Indian Reservation, Bingham County, about 16 miles east of Fort Hall. Here power shovels strip, mine, and load the phosphate rock into pit trucks for transportation to railhead for loading into cars to be taken to the superphosphate plant and electric furnaces near Pocatello. Caterpillar-powered scrapers and bulldozers assist in the stripping. Phosphatic shale beds containing 25 percent P_2O_5 overlie a 6-foot bed of high-grade phosphate rock. The phosphate shales are mined and shipped to the Westvaco electric elemental phosphorus furnaces near Pocatello, and the higher-grade phosphate rock is utilized for superphosphate at the Simplot plant near the same place. Stripping operations were started in June 1946, and about 53,000 tons of phosphate rock produced in that year. In 1947, because of United States Army requirements for export to Japan, nearly 500,000 tons of phosphate rock were produced. Production in later years has been much smaller. In 1949 the Simplot Fertilizer Co. completed crushing, screening, and sampling plants in the Fort Hall area. At Pocatello it finished an addition to its acidulation plant. Soil-building mixing plants were constructed at Greeley, Colo.; Klamath Falls, Idaho; and Idaho Falls, Idaho. Large quantities of phosphatic shales were shipped in 1949 to the Westvaco furnace at Pocatello for the production of elemental phosphorus; a considerable tonnage of the phosphate rock produced was used by the Simplot Co. for the production of superphosphate, and a large amount was exported.

Details of the operations of the Simplot Fertilizer Co. are given in several articles published in 1949.[9] The Simplot Fertilizer Co. is reported to have started production of ammonium phosphate and ammonium sulfate at the old Kalunite plant in Salt Lake City in the summer of 1949.

The Westvaco Chemical Division, Food Machinery & Chemical Corp., completed the construction of its first electric furnace at Pocatello, Idaho, in 1949 and began its operation in the summer of

[8] Norris, E. M., Idaho Phosphate: Paper read at the Annual Meeting of the Idaho Mining Association at Sun Valley, Idaho, June 13 to 15, 1949, 5 pp. (mim.).
Long, A. E., Experimental Diamond Core Drilling in the Phosphoria Formation in Southeastern Idaho: Bureau of Mines Rept. of Investigations 4597, 1949, 29 pp.
Butner, D. W., Phosphate Rock Mining in Southeastern Idaho: Bureau of Mines Inf. Circ. 7529, 1949, pp. 18.

[9] Fowler, H. B., Phosphate Mining by the Simplot Fertilizer Co. near Fort Hall, Idaho: Am. Inst. Min. and Met. Eng., Min. Trans., vol. 184, August 1949, pp. 291–295.
Fowler, H. B., How Simplot Solved a Complex Stripping Problem: Eng. and Min. Jour., vol. 150, No. 10, October 1949, pp. 92–93.
Pit and Quarry, Over a Million Tons of Earth Moved to Get Phosphate Ore: Vol. 42, No. 1, July 1949, pp. 161–162.
Rock Products, Open-Pit Phosphate Mine: Vol. 52, No. 6, June 1949, pp. 104–105.

that year. Construction of a second furnace was in progress during the later part of the year, with operation expected in 1950. Facilities for converting phosphorus from this second unit are being provided through expansion of the division's Carteret, N. J., phosphate plant, and through erection of a new phosphate plant on the Pacific coast at Newark, Calif. It will adjoin the magnesium oxide plant now operated at Newark by the Westvaco Chemical Division. Westvaco is to use the low-grade phosphatic shales from the Fort Hall deposits, and Simplot is to continue making fertilizer from the high-grade deposits. The first of the electric furnaces is said to have a phosphorus-producing capacity of 8,000 tons a year; the second furnace is expected to turn out 9,000 tons of elemental phosphorus a year. The company obtains its phosphate shale under a long-term contract with the J. R. Simplot Co. The reserves of the phosphate shale are stated to be sufficient to keep the two furnaces running at rated capacity for at least 25 years.

The Anaconda Copper Mining Co. operated its No. 3 mine at Conda, Caribou County, Idaho, processing the phosphate rock produced at the company's plant at Anaconda, Mont., largely to high-analysis superphosphate. A smaller quantity went into the manufacture for sale of phosphoric acid and phosphate chemicals. None was exported. The deposits and operations at the mine and plants have been described in recent articles.[10] The company completed a plant expansion program at Anaconda, Mont., in 1949.

The San Francisco Chemical Co., Montpelier, Idaho, reported that it did not operate its Waterloo mine on the slopes of Waterloo Hill, 5 miles east of Montpelier, in 1949. The open-pit operations on this property in 1947 were described in a recent article.[11]

The property of the Teton Phosphate Co., Inc., Montpelier, Idaho, was inactive during 1949. Development work is reported on a phosphate-rock property (McIllwee) near Paris, Idaho.

A treble-superphosphate plant, producing and using wet-process phosphoric acid for the production of treble superphosphate, was completed in 1949 at Wendell, southern Idaho. It was built by Gates Bros., Inc., in cooperation with the Idaho Farm Bureau Federation. The formal opening of this plant of the Gem State Phosphate Co. was held at Wendell, Idaho, August 5, 1949, and the plant is said to have started operation near the end of the year. A spur connects the plant with the Union Pacific Railroad. Phosphate rock for operation of the plant is to come from deposits reported leased by the Idaho Farm Bureau Federation, Gem State Phosphate Co., and Gates Bros., Inc., in the region of the Idaho-Wyoming-Utah boundary. The reported daily capacity of the plant is 100 short tons of treble superphosphate. The product, "Gem State phosphate," is to go to the members of the Idaho Farm Bureau Federation. These groups report that no phosphate rock was produced from their properties in 1949.

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[10] Butner, D. W., Phosphate Rock Mining in Southeastern Idaho: Bureau of Mines Inf. Circ. 7529, 1949, 13 pp. See pp. 4, 7, and 14.
Engineering and Mining Journal, Western Phosphate Output Soars: Vol. 150, No. 7, July 1949, pp. 130–133, See p. 132.
Russell, T. C., Mining of Phosphate Rock at Conda, Idaho: Am. Inst. Min. and Met. Eng., Min. Trans. vol. 184, August 1949, pp. 279–282.
Caro, R. J., Anaconda Phosphate Plant, Beneficiation and Treatment of Low Grade Phosphate Rock: Am. Inst. Min. and Met. Eng., Min. Trans., vol. 184, August 1949, pp. 282–284.

[11] King, D. L., Surface Strip Phosphate Mining at Leefe, Wyoming, and Montpelier, Idaho: Am. Inst. Min. and Met. Eng., Min. Trans., vol. 184, August 1949, pp. 284–287.

That used in the plant was said to have been purchased from other mining companies.

The Pacific Supply Cooperative has obtained a Government phosphate lease on 1,500 acres of the Dry Ridge deposit near Soda Springs, Idaho. Ten miles south of this deposit is the Georgetown Canyon phosphate-rock deposit, said to have been recently purchased by 15 midwestern cooperatives forming the Central Farmers Association of Chicago. Extensive core drilling has been under way at this location.

Montana.—Montana phosphate-rock production continues to increase; its rising output approached the declining output of Idaho in 1949. Shipments from Montana mines in 1949 totaled 355,169 long tons valued at $2,574,330. Both quantity and value exceeded those of 1948; both were new records. The Montana Phosphate Products Co., Trail, British Columbia, was the largest producer and shipper in the Western States. It operated its Anaconda, Anderson, and Graveley mines, as well as several Government leases, all in the Garrison district, Powell County. All of the rock shipped was exported to the plant of the parent company at Trail, British Columbia. Operations at the three underground mines of this company, all reported on the same phosphate-rock bed in the Phosphoria formation, were described in recent articles.[12]

Mining operations were also carried on by George Relyea at the Relyea mine, also in the Garrison district; and the production was also exported to Trail, British Columbia. Anderson Bros. Mining Co., Box 322, Butte, Mont., mined and shipped a small tonnage of phosphate rock in 1949 from another property in the Garrison district. The Silica Products Co., Inc., 433 Provident Building, Tacoma 2, Wash., which has under lease 1 mile along the outcrop of a phosphate-rock bed in sec. 29, T. 10 N., R. 6 W., in the Elliston phosphate field, Powell County, Mont., reports that it was not in production in 1949, and no phosphate rock was shipped.

In the Philipsburg district, Granite County, only Manganese Products, Inc., Seattle, Wash., and Soluble Phosphates, Ltd., Maxville, Mont., were in operation in 1949. The former operated the Edgar mine, near Hall, Granite County, and the Red Hill mine near Philipsburg and shipped phosphate rock to Seattle, Wash., for the production of a fused calcium-magnesium-phosphate fertilizer. This plant was described in recent articles.[13] A small tonnage was produced by Soluble Phosphates, Ltd., and sold for direct application to the soil. The Moonlight Mining Co. (Roy Atkinson), Ronan, Mont., reports that no phosphate rock was shipped from the Moonlight mine near Princeton in 1949 and that the company has passed into the hands of a receiver.

Utah.—Only a few hundred tons of phosphate rock are known to have been produced in Utah during 1949. This resulted from development work at the property of the F. J. Pearl Minerals Co. (153 North Willow Ave., Baldwin Park, Calif.), at the south end of the Crawford Mountains, in Rich County, in northeastern Utah, near Woodruff,

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[12] Armstrong, R. C., and McKay, J. E., Mining Operations of the Montana Phosphate Products Co.: Am. Inst. Min. and Met. Eng., Min. Trans., vol. 184, August 1949, pp. 287–291.
Engineering and Mining Journal, Western Phosphate Output Soars: Vol. 150, No. 7, July 1949, pp. 130–133.

[13] Moulton, R. W., Electric Furnace Fertilizers—Ca Mg Phosphate: Chem. Eng., vol. 56, No. 7, July 1949, pp. 102–104.
Engineering and Mining Journal, Electric Furnace Used on Phosphate and Olivine: Vol. 150, No. 5, May 1949, p. 98.

in the W½W½ sec. 36, T. 10 N., R. 7 E., S. L. B. M. This is on land leased in 1949 from the Utah State Land Board. Development work done consisted of a tunnel about 165 feet long driven in a steeply inclined phosphate-rock bed reportedly 4 to 5 feet thick, averaging 30 percent P_2O_5. No phosphate rock was shipped from this property during 1949.

The Garfield Chemical & Manufacturing Corp., Salt Lake City, Utah, has in the past produced a small amount of metallurgical phosphate rock yearly from a Federal lease in the Spanish Fort Canyon area in Utah County, near Springville, Utah. None was produced in 1949. The Utah Phosphate Co., Morgan, Utah, with a phosphate-rock mine and mill near Morgan, Morgan County, Utah, did not report any operations in 1949. No operations were reported on the phosphate-rock deposit in Old Laketown Canyon in northeastern Utah, although it had been stated that such were intended.

Wyoming.—The reported production and shipments of Wyoming phosphate rock in 1949 decreased greatly from the 1948 figures; but the State, in third place among the Western States group, remains an important producer. Only one company was producing in 1949—the San Francisco Chemical Co., operating the Leefe mine on land leased from the Stauffer Chemical Co., in the Beckwith Hills syncline, 3½ miles west of Sage, in Lincoln County, Wyo., a station on the main line of the Union Pacific Railroad in southwestern Wyoming. A railroad spur connects the mine with the main line at a point 1 mile west of Sage. A description of the phosphate rock deposit and the operations of the company was published in 1949.[14]

Development work only is reported at the mine of Phosphate Mines. Inc., Kemmerer, Wyo., 7 miles north of that place, but several hundred tons were sold from stock for use as a fertilizer in direct application to the soil.

Whereas the highest-grade phosphate-rock deposits of Wyoming are found in the western part of the State, the lower-grade beds along the northeastern flank of the Wind River Mountains near Lander in west central Wyoming, are considered very important because of their nearness to the railroads, to the growing midwestern phosphatic fertilizer market, and to adequate coal reserves and potential power. Field and laboratory research is being carried on jointly by Federal and State agencies. One report resulting from these investigations was published early in 1949.[15] There has been no commercial production from the phosphate beds of the Wind River Range.

The United States Department of the Interior announced on December 14, 1949, a phosphate lease sale for 10 units totaling more than 15,500 acres of phosphate-rock-bearing land in Fremont County, Wyo. The sale was to be held on February 8, 1950, in Washington, D. C. Approximately 154 acres lie within the Shoshone National Forest.

Two reports of investigations of the vanadium deposits in the phosphate rock bearing Phosphoria formation in the Sublette Ridge

[14] King, D. L., Surface Strip Phosphate Mining at Leefe, Wyo., and Montpelier, Idaho: Am. Inst. Min. and Met. Eng., Min. Trans., vol. 184, August 1949 pp. 284-287.

[15] King, W. H., and Schumacher, J. I., Investigation of the Lander Phosphate Rock Deposits, Fremont County, Wyo.: Bureau of Mines Rept. of Investigations 4437, 1949, 12 pp.

and Salt River Range of Lincoln County, Wyo., contain data of interest to the phosphate-rock industry.[16]

California.—California does not produce phosphate rock. Submarine phosphorite deposits, however, have been reported off the California coast.[17] Phosphate fertilizers are produced in the State from phosphate rock and phosphate chemicals from phosphoric acid shipped in from Eastern States. The Permanente Metals Co., Permanente, Calif., has been producing a fused calcium-magnesium-phosphate fertilizer from serpentine and Idaho phosphate rock.[18] Late in 1949 the name of the company was changed to the Kaiser Aluminum & Chemical Corp. The only phosphate chemical plant on the west coast has been that of the A. R. Maas Chemical Co. at South Gate, Calif., near Los Angeles, where elemental phosphorus was burned to phosphoric acid and phosphate chemicals. This plant, founded in 1919 by A. R. Maas, was acquired in 1949 by the Victor Chemical Works, Chicago, Ill. This company produces elemental phosphorus at Mount Pleasant, Tenn., and Victor, Fla., and now has processing plants at Chicago Heights, Ill., Nashville, Tenn., Morrisville, Pa., and South Gate, Calif.

FOREIGN TRADE[19]

Data on imports and exports of phosphate rock and other phosphatic materials are shown in the following tables.

Phosphate rock and phosphatic fertilizers imported for consumption in the United States, 1948–49

[U. S. Department of Commerce]

Fertilizer	1948		1949	
	Long tons	Value	Long tons	Value
Apatite			3,428	$43,002
Phosphates, crude, not elsewhere specified	48,104	$608,932	61,463	778,840
Superphosphates (acid phosphate):				
Normal (standard), not over 25 percent P_2O_5 content	2,702	73,808	1,273	35,620
Concentrated (treble), over 25 percent P_2O_5 content	527	25,287		
Total superphosphates	3,229	99,095	1,273	35,620
Ammonium phosphates, used as fertilizer	96,632	6,127,968	112,745	7,543,101
Bone dust, or animal carbon and bone ash, fit only for fertilizer	7,398	411,252	27,320	1,394,085
Guano	29	1,343		
Slag, basic, ground or unground	29	559	94	267
Precipitated bone, fertilizer grade	458	23,146	3,619	247,133

[16] Allsman, P. T., Majors, F. H., Mahoney, S. R., and Young, W. A., Investigation of Sublette Ridge Vanadium Deposit, Lincoln County, Wyo.: Bureau of Mines Rept. of Investigations 4476, 1949, 8 pp. Allsman, P. T., Majors, F. H., Mahoney, S. R., and Young, W. A., Investigation of Salt River Range Vanadium Deposits, Lincoln County, Wyo.: Bureau of Mines Rept. of Investigations 4503, 1949, 18 pp.

[17] Emery, K. O., and Dietz, R. S., Submarine Phosphorite Deposits off California and Mexico: California Jour. Mines and Geology, vol. 46, No. 1, January 1950, pp. 7–15.

[18] Crossman, Ralph, Permanente Produces New Phosphatic Fertilizer: Commercial Fertilizer, vol 79, No. 3, September 1949, pp. 41–42.

[19] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the United States Department of Commerce. Phosphate-rock export figures do not include Army shipments to occupied territories in 1946.

Phosphate rock exported from the United States, 1948–49, by countries of destination and grades

[U. S. Department of Commerce]

State of origin and country of destination	1948		1949	
	Long tons	Value	Long tons	Value
Florida:				
High-grade hard rock:				
Belgium-Luxembourg	600	$4,920		
Canada			4,308	$51,440
Colombia			304	5,120
Cuba	5,540	34,957		
Germany	36,075	249,977		
Sweden	25,920	234,442	11,550	106,838
United Kingdom	8,036	56,252		
Total high-grade hard rock	76,171	580,548	16,162	163,398
Land pebble:				
Belgium-Luxembourg	71,799	598,325	64,176	544,564
Brazil	1,999	18,991	5,000	51,350
British Guiana	882	11,486	363	4,752
Canada	143,203	1,236,181	173,437	1,578,767
Colombia	600	9,919	404	5,595
Costa Rica			90	1,275
Cuba	8,314	54,059	16,662	119,052
Ecuador			200	2,390
El Salvador			132	1,478
Germany	76,667	601,066	173,158	1,315,049
India	4,000	60,525		
Italy	97,063	846,253	54,939	485,156
Japan			105,048	536,571
Korea			9,842	82,131
Mexico	8,624	47,325	3,130	15,495
Netherlands	42,984	386,990	77,438	669,150
Sweden	8,011	71,137	17,596	158,364
Switzerland	5,010	45,182	9,020	81,180
United Kingdom	64,584	466,587	82,533	576,745
Uruguay	2,024	17,609	1,994	21,755
Total land pebble	535,764	4,471,635	795,162	6,250,819
Other phosphate rock:[1]				
British Guiana	3	60		
Canada	279,078	3,180,845	351,385	4,191,958
Colombia	36	735	850	12,908
El Salvador			270	3,296
Japan	250,312	2,251,353	94,085	1,208,358
Mexico			46	641
Philippines			2	148
Total other phosphate rock	529,429	5,432,993	446,638	5,417,309
Grand total	1,141,364	10,485,176	1,257,962	11,831,526

[1] Includes colloidal matrix; sintered matrix; soft phosphate rock; and Tennessee, Idaho, and Montana rock.

Other phosphate material[1] exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Long tons	Value	Year	Long tons	Value
1945	1,732	$140,363	1948	1,002	$188,163
1946	1,018	144,478	1949	3,225	224,375
1947	1,129	220,906			

[1] Class includes animal carbon; apatite; bone ash, dust, and meal; char dust; duplex basic phosphate; tricalcium phosphate; and defluorinated phosphate rock.

Superphosphates (acid phosphates) exported from the United States, 1948–49, by countries of destination

[U. S. Department of Commerce]

Country of destination	1948		1949	
	Long tons	Value	Long tons	Value
Argentina	600	$15,456		
Austria			9,343	$189,941
Brazil	26,088	648,592	37,597	812,813
British East Africa	890	80,400	442	33,500
Canada	97,939	1,794,833	135,491	2,393,711
Newfoundland-Labrador	8,100	138,834		
Chile	867	64,049	103	6,105
Colombia	2,132	155,180	3,615	254,270
Costa Rica	196	5,988	649	35,380
Dominican Republic	293	29,164	575	26,983
El Salvador	418	26,692	303	10,732
Germany	39,473	818,445	20,597	575,522
Guatemala	30	1,247	180	7,457
Iceland	625	45,500		
Israel and Jordan			688	40,296
Japan			9,643	151,206
Korea	160,322	3,354,738	63,970	1,096,359
Mexico	1,982	81,480	267	18,767
Union of South Africa	18,600	318,730	22,330	344,133
Venezuela	1,473	48,548	94	3,645
West Indies:				
British:				
Leeward and Windward Islands	412	7,766	259	7,405
Trinidad and Tobago	1,357	39,690		
Other British	27	1,063	121	3,131
Cuba	19,652	456,114	8,335	236,913
Haiti	83	2,498	4	304
Other countries	1,280	62,151	1,382	78,136
Total	382,839	8,197,158	315,988	6,326,709

TECHNOLOGY

Various papers on developments in phosphate-rock technology that have been published recently are listed below.[20]

[20] Sauchelli, Vincent, Evolution in Fertilizer Phosphate Industry: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1314–1315.
Wilkerson, T. L., Processing Phosphate Rock for Use in Agriculture: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1316–1317.
Bridger, G. L., Moore, J. W., McLeod, H. M., Jr., Phosphatic Animal Feed Supplement—Laboratory and Pilot Plant Production: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1391–1396.
Williams, D. E., MacLeod, F. L., Morrell, Elise, and Patrick, Homer, Phosphatic Animal-Feed Supplement—Animal Feeding Tests: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1396–1400.
Demmerle, R. L., and Sackett, W. J., Continuous Superphosphate Production: Ind. Eng. Chem. vol. 41, No. 7, July 1949, pp. 1306–1313.
Atwell, James, Phosphate Processes at Trail, B. C.: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1318–1324.
Whitney, W. T., and Hollingsworth, C. A., Production of Defluorinated Phosphate Rock—Calcining Without Fusion in Rotary Kilns: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1325–1327.
Hill, W. L., Fox, E. J., and Mullins, J. F., Preparation of Radioactive Phosphate Fertilizers—Field Tests by Tracer Methods: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1328–1334.
Shoeld, Mark, Wight, E. H., and Sauchelli, Vincent, Rock-Acid Ratio in Superphosphate Manufacture: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1334–1337.
Jorge, Garibay R., Instrumentation for Superphosphate Manufacture: Ind. Eng. Chem., vol. 41, No. 7, July 1949, pp. 1338–1340.
Rothermel, J. J., Sun Kuan-Han, and Silverman, Alexander, Phosphate Glass: PbO-WO_3-P_2O_5 System: Jour. Am. Ceram. Soc., vol. 32, No. 5, May 1, 1949, pp. 153–162.
Weyl, W. A., Phosphate Glasses: Chem. and Eng. News, vol. 27, No. 15, Apr. 11, 1949, pp. 1048–1049.
Perhert, J. C., and Brown, J. H., Some Reactions and Properties of the Phosphorus Sulfides: Chem. and Eng. News, vol. 27, No. 30, July 25, 1949, pp. 2143–2145.
Hignett, T. P., and Siegel, M. R., Recovery of Fluorine from Stack Gases: Ind. Eng. Chem., vol. 41, No. 11, November 1949, pp. 2493–2498.
Thompson, H. L., Miller, Philip, Dale, F. H., and Kaplan, Abraham, Properties of Diammonium Phosphate Fertilizer Produced by Saturator Process: Ind. Eng. Chem., vol. 49, No. 3, March 1949, pp. 485–494.
Van Wazer, J. R., Physical Properties of Solutions of a Sodium Phosphate Glass: Ind. Eng. Chem., vol. 41, No. 1, January 1949, pp. 189–194.
MacIntire, W. H., Hardin, L. J., and Johnson, H. S., Jr., Development of Available Magnesia—Results of Reactivity of Concentrated Superphosphate in Mixtures with Olivine, Serpentine, Magnesite, and Their Calcines: Ind. Eng. Chem., vol. 41, No. 5, May 1949, pp. 1079–1081.

WORLD PRODUCTION

The following table gives available figures on production of phosphate rock in various countries in recent years.

World production of phosphate rock, by countries,[1] 1944–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1944	1945	1946	1947	1948	1949
Algeria	220,349	401,304	584,827	713,790	670,591	645,906
Angaur Island	[2] 26,417	(3)	[4] 94,000	[4] 170,000	(3)	(3)
Australia:						
New South Wales	-----	-----	-----	231	488	(3)
South Australia	4,167	725	20	5,171	1,682	-----
Western Australia	2,251	8,619	-----	-----	-----	-----
Austria	(3)	(3)	3,240	11,525	(3)	(3)
Belgium	52,270	17,990	69,927	58,045	68,938	44,643
Brazil (apatite)	5,216	7,463	10,421	5,592	(3)	4,553
British Borneo (guano)	(3)	(3)	(3)	(3)	427	508
Canada	437	271	52	-----	-----	11
Chile (apatite)	14,376	13,203	15,210	13,994	59,529	(3)
Christmas Island (exports)	-----	[4] 6,096	34,444	106,765	108,311	255,236
Curacao (N. W. I.)	7,813	8,770	73,594	79,229	58,827	92,784
Egypt	318,185	349,374	294,046	371,227	377,005	350,000
France	92,966	75,459	97,285	104,068	(3)	(3)
French Indochina:						
Phosphate rock	6,850	-----	-----	-----	-----	-----
Apatite	300	-----	-----	-----	-----	-----
French Morocco	1,444,902	1,654,120	2,783,580	2,960,735	3,226,700	3,693,000
French Oceania (exports)	203,300	259,000	241,085	205,136	183,104	239,532
Germany	[4] 1,000	[4] 500	[4 5] 400	[5] 698	[5] 473	(3)
India	232	532	247	867	1,132	(3)
Indonesia	[4] 24,000	(3)	-----	-----	-----	-----
Ireland	19,978	22,110	12,189	10,780	(3)	(3)
Israel and Jordan (exports)	4,961	4,867	4,024	6,058	(3)	(3)
Italy	-----	1,600	-----	-----	(3)	(3)
Japan	52,835	(3)	7,985	6,802	3,590	684
Korea	33,530	(3)	(3)	(3)	(3)	(3)
Nauru and Ocean Island (exports)	-----	-----	88,244	390,062	671,152	1,067,157
New Zealand	20,251	8,084	11,224	203	-----	(3)
Seychelles Islands (exports)	5,941	7,090	21,397	14,516	21,924	14,243
Southern Rhodesia	-----	-----	-----	9	-----	67
South-West Africa (guano)	964	27	1,665	2,223	1,038	957
Spain	17,770	20,349	18,608	20,204	23,012	23,093
Sweden (apatite)	160,847	171,127	50,730	7,696	1,441	(3)
Tanganyika Territory	28	9	279	220	313	157
Tunisia	501,990	706,404	1,399,880	1,755,226	1,863,710	1,441,918
Uganda	-----	8,648	7,213	7,269	-----	-----
Union of South Africa	21,088	27,342	37,691	41,831	39,656	56,471
U. S. S. R. (apatite) [4]	1,016,000	1,626,000	1,626,000	2,032,000	(3)	(3)
United States (sold or used by producers)	5,462,938	5,899,921	6,970,827	9,171,914	8,807,903	9,131,173
Total (estimate) [1]	9,746,000	11,420,000	14,581,000	18,294,000	18,493,000	19,412,000

[1] In addition to countries listed, Cayman Islands (B. W. I.), China (including Formosa), Madagascar, New Caledonia, Philippines, Poland, and Rumania produce phosphate rock; but data of output are not available, and no estimates have been included in the total.
[2] Exports.
[3] Data not available; estimate by author of chapter included in total.
[4] Estimate.
[5] Bizonal.

BASIC SLAG

Basic slag is only a limited source of agricultural phosphorus in the United States. Domestic production comes from a single company smelting a phosphatic iron ore of the Birmingham, Ala., district; no figures of production or sales have been released for publication by this company. Annual imports are negligible. In 1948 only 29 long tons were imported; in 1949, only 94 tons.

Platinum-Group Metals

By Hubert W. Davis and Charlotte R. Buck

GENERAL SUMMARY

THE DEMAND for platinum in 1949 continued a downward trend that had persisted for four consecutive years, and the retail price dropped from $96 an ounce to $72. Demand for palladium was also at a much lower level and the decline more pronounced than for platinum; however, the price remained static at $24 an ounce. Demand for iridium, osmium, and rhodium was likewise smaller, but that for ruthenium was slightly larger. The prices of ruthenium and iridium dropped $24 and $10 an ounce, respectively, but quotations on osmium and rhodium remained unchanged. Refining of palladium and osmium was greater in 1949 than in 1948, that of platinum, rhodium, and ruthenium was smaller, but that of iridium was virtually the same in both years. Imports of refined platinum, palladium, iridium, and osmium were smaller than in 1948, but those of rhodium and ruthenium were larger. Receipts of palladium from the U. S. S. R.—the chief source of the 1948 imports—were conspicuous by their absence in 1949. A noteworthy development in 1949 was perfection of a new refining method for producing high-octane gasoline from low-grade and natural gasoline with the aid of platinum catalysts.

Salient statistics of platinum-group metals in the United States, 1948–49, in troy ounces

	1948	1949		1948	1949
Production:			Stocks in hands of refiners, importers, and dealers, Dec. 31:		
Crude platinum from placers	13,741	17,169	Platinum	146,823	138,049
New metals:			Palladium	142,211	122,408
Platinum	33,520	42,228	Other	34,540	35,587
Palladium	4,408	6,008	Total	323,574	296,044
Other	1,663	3,690	Imports for consumption:		
Total	39,591	51,926	Unrefined materials	33,654	33,748
Secondary metals:			Refined metals	[1] 239,079	184,536
Platinum	58,527	41,734	Total	[1] 272,733	218,284
Palladium	28,418	37,209	Exports:		
Other	6,956	4,504	Ore and concentrates	5	165
Total	93,901	83,447	Refined metals and alloys, including scrap	36,465	40,778
Consumption:			Manufactures (except jewelry)	4,874	20,702
Platinum	177,441	152,658			
Palladium	167,610	116,235			
Other	21,797	19,730			
Total	366,848	288,623			

[1] Revised figure.

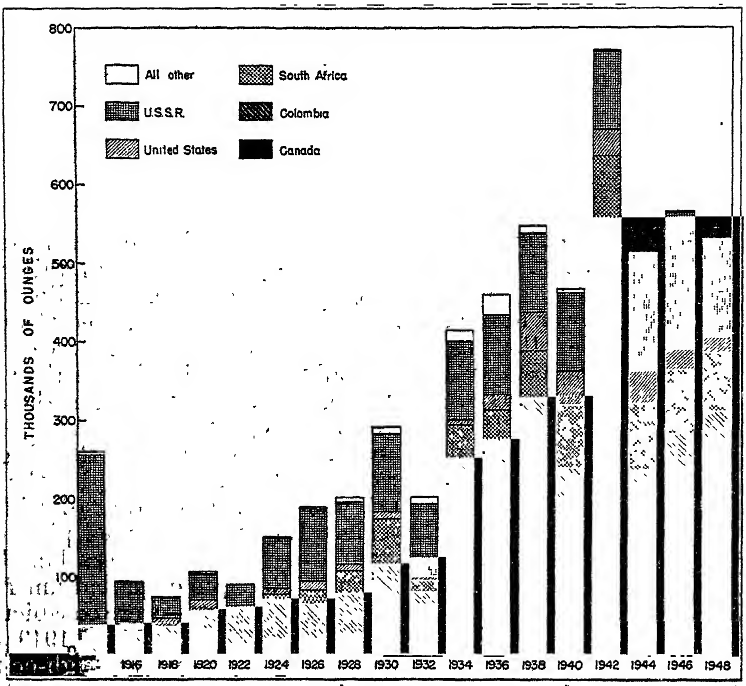

FIGURE 1.—Trend in world production of platinum-group metals, 1914–48.

Platinum was refined in the United States in 1949 at a rate 9 percent lower than in 1948 and 50 percent below the demand, which declined 13 percent. The refined-metal deficiency was met by imports of 95,070 ounces, chiefly from Canada (66,583 ounces) and United Kingdom (14,144 ounces). The jewelry trade was again by far the largest outlet for platinum, taking 53 percent of the total sold to domestic consumers. Sales to the jewelry industry were slightly less in 1949 than in 1948, and those to the dental trade were virtually unchanged, but those to the chemical and electrical industries were smaller by 23 and 32 percent, respectively.

Palladium was refined in the United States in 1949 at a rate 32 percent higher than in 1948. The quantity refined in 1949, however, was 68 percent less than sales, which were 26 percent smaller than in 1948. The deficit in palladium was partly met by imports of 73,770 ounces, chiefly from Canada (53,761 ounces), Switzerland (8,720 ounces), and United Kingdom (6,799 ounces) and partly by withdrawals from stocks of refiners and dealers. The much smaller sales of palladium to the chemical and electrical industries in 1949 were slightly offset by moderately greater sales to the dental and jewelry industries and for export.

More osmium but less rhodium and ruthenium were refined in the United States in 1949 than in 1948. Refining of iridium, however, was virtually the same in both years. More rhodium and ruthenium but less iridium and osmium were imported than in 1948. Sales to

domestic consuming industries of iridium, osmium, and rhodium were smaller by 7, 50, and 3 percent, respectively, than in 1948, but those of ruthenium were up 4 percent; sales of osmium and ruthenium for export were substantially greater, but those of iridium and rhodium were much smaller than in 1948.

Imports of platinum-group metals into the United States in 1949 were 20 percent less than in 1948.

Figure 1 shows graphically the trend in world production of platinum-group metals since 1914.

CRUDE PLATINUM PRODUCTION

Crude platinum-group metals were produced in Alaska and California in 1949 and totaled 17,169 ounces, compared with 13,741 ounces in 1948. The Alaskan production came from placer deposits in the Goodnews Bay district of southwestern Alaska, and the California output was a byproduct of gold placers in Butte, Merced, Sacramento, Siskiyou, Stanislaus, and Yuba Counties.

Many gold and copper ores in the United States contain small quantities of platinum-group metals. In 1949, 7,638 ounces of platinum-group metals were recovered as byproducts of refining gold and copper ores compared with 5,512 ounces in 1948.

Source of Purchases.—Purchases of domestic crude platinum-group metals by buyers in the United States were reported from Alaska and California in 1949 and totaled 17,063 ounces (13,871 ounces in 1948). Domestic buyers also reported purchases of 30,612 ounces of foreign crude platinum-group metals from Colombia, 2,106 ounces from Union of South Africa, 299 ounces from Ethiopia, 102 ounces from Canada, and 51 ounces from Panama in 1949—a total of 33,170 ounces (23,245 ounces in 1948).

RECOVERY OF REFINED PLATINUM-GROUP METALS

New Metals Recovered.—Reports from refiners of crude platinum-group metals, gold bullion, and copper indicate that 51,926 ounces of platinum-group metals were recovered in the United States from such sources in 1949—an increase of 31 percent over 1948. Of the new metals recovered in 1949, 58 percent was chiefly from crude from Colombia, 27 percent was from domestic crude (largely Alaska), and 15 percent was a byproduct of domestic gold and copper ores.

Secondary Metals Recovered.—In 1949, 83,447 ounces of secondary platinum-group metals were recovered from the refining of scrap metal, sweeps, and other waste products of manufacture that contain platinum-group metals—an 11-percent decrease from 1948.

Substantial quantities of worn-out catalysts, spinnerets, laboratory ware and other products are returned by consumers to refiners for refining. The refined platinum-group metals recovered from these products (or their equivalent in refined metals) are returned to the consumers. The platinum-group metals so recovered are not included in the statistics of secondary metals.

New platinum-group metals recovered by refiners in the United States, 1941–1944 (average) and 1945–47, and 1948–49 by sources, in troy ounces

	Platinum	Palladium	Iridium	Osmium	Rhodium	Ruthenium	Total
1941–44 (average)	177,343	70,870	4,047	702	4,600	2,751	260,313
1945	162,032	28,649	5,783	845	4,731	2,466	204,506
1946	92,947	3,858	2,995	475	1,396	107	101,778
1947	54,011	4,156	1,605	419	563	103	60,857
1948							
From domestic—							
Crude platinum	[1] 9,822	31	694	260	137	95	[1] 11,039
Gold and copper refining	1,251	4,261					5,512
Total	[1] 11,073	4,292	694	260	137	95	[1] 16,551
From foreign—Crude platinum and nickel and copper refining	[1] 22,447	116	315	89	19	54	[1] 23,040
Total recovery	33,520	4,408	1,009	349	156	149	39,591
1949							
From domestic—							
Crude platinum	12,564	92	1,286	238	144	12	14,336
Gold and copper refining	1,844	5,794					7,638
Total	14,408	5,886	1,286	238	144	12	21,974
From foreign crude platinum	27,820	122	845	742	64	359	29,952
Total recovery	42,228	6,008	2,131	980	208	371	51,926

[1] Revised figure.

Secondary platinum-group metals recovered in the United States, 1940–44 (average) and 1945–49, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1940–44 (average)	59,177	19,424	1,462	3,054	83,117
1945	58,942	32,968	812	3,400	96,122
1946	40,385	27,856	2,002	2,394	72,637
1947	54,190	27,492	2,089	3,317	87,088
1948	58,527	28,418	2,214	4,742	93,901
1949	41,734	37,209	1,101	3,403	83,447

CONSUMPTION

As pure metals, combined, clad, or alloyed with other metals, the platinum-group metals are utilized in the electrical and chemical industries, in dentistry and jewelry, and for numerous miscellaneous purposes. Uses of the platinum-group metals are tabulated in Minerals Yearbook, 1943 (p. 801).

Sales of platinum-group metals to consumers in the United States were 288,623 ounces in 1949 compared with 366,848 ounces in 1948. Sales for export, as reported to the Bureau of Mines, were 36,143 ounces in 1949 compared with 33,513 ounces in 1948.

Platinum continued to be the most widely used metal of the group, and in 1949 total sales were 23 percent greater than those of palladium. Sales of platinum constituted 152,658 ounces (53 percent) of the total platinum-group metals sold to domestic consumers in 1949. The jewelry trade was again the chief buyer of platinum, taking 53 percent of the total sold to domestic consumers, but its purchases (80,426 ounces) were 2 percent less in 1949 than in 1948. Sales of platinum

to the electrical industry declined 32 percent to 28,699 ounces, and as a consequence it dropped to third place in 1949. The chemical industry, which purchased 32,179 ounces in 1949, ascended to second place as a buyer of platinum, although its purchases were down 23 percent. A noteworthy development in 1949 was perfection of a new refining method for producing high-octane gasoline from lower-grade and natural gasoline with the aid of platinum catalysts. Sales of platinum to the dental trade were virtually the same in 1949 as in 1948, but sales for export (14,456 ounces) were 4 percent smaller.

Next to platinum, palladium is the metal of the group used most extensively; it comprised 116,235 ounces (40 percent) of the total platinum-group metals sold to domestic consumers in 1949. The electrical industry retained first place as a buyer of palladium in 1949 by taking 54,275 ounces (47 percent) of the total palladium sold to domestic consumers, even though sales to the electrical industry were 48 percent less than in 1948—the all-time high. Less palladium was also sold to the chemical industry, but sales to the dental industry and for export (19,712 ounces) were greater. Palladium catalysts are playing an important role in the manufacture of the newer antibiotics, developed after penicillin. Sales to the jewelry trade were virtually the same in 1949 as in 1948.

Sales of the other platinum-group metals—iridium, osmium, rhodium, and ruthenium—were comparatively small; they made up only 7 percent of the total platinum-group metals sold in 1949. Domestic demand for iridium, osmium, and rhodium was 7, 50, and 3 percent, respectively, less than in 1948, but that for ruthenium 4 percent more. Exports of iridium, osmium, rhodium, and ruthenium, as reported to the Bureau of Mines, were 1,975 ounces in 1949 compared with 2,716 ounces in 1948.

The accompanying table shows sales of platinum-group metals to consuming industries in the United States in 1948 and 1949.

Platinum-group metals sold to consuming industries in the United States in 1948 and 1949, in troy ounces

Industry	Platinum	Palladium	Iridium, osmium, rhodium, and ruthenium	Total
1948				
Chemical	41,778	13,816	5,722	61,316
Electrical	42,306	105,033	2,784	150,123
Dental and medical	9,494	16,740	171	26,405
Jewelry and decorative	81,756	31,783	10,589	124,128
Miscellaneous and undistributed	2,107	238	2,531	4,876
Total	177,441	167,610	21,797	366,848
1949				
Chemical	32,179	9,580	4,454	46,213
Electrical	28,699	54,275	2,124	85,098
Dental and medical	9,505	19,901	121	29,527
Jewelry and decorative	80,426	32,060	10,792	123,278
Miscellaneous and undistributed	1,849	419	2,239	4,507
Total	152,658	116,235	19,730	288,623

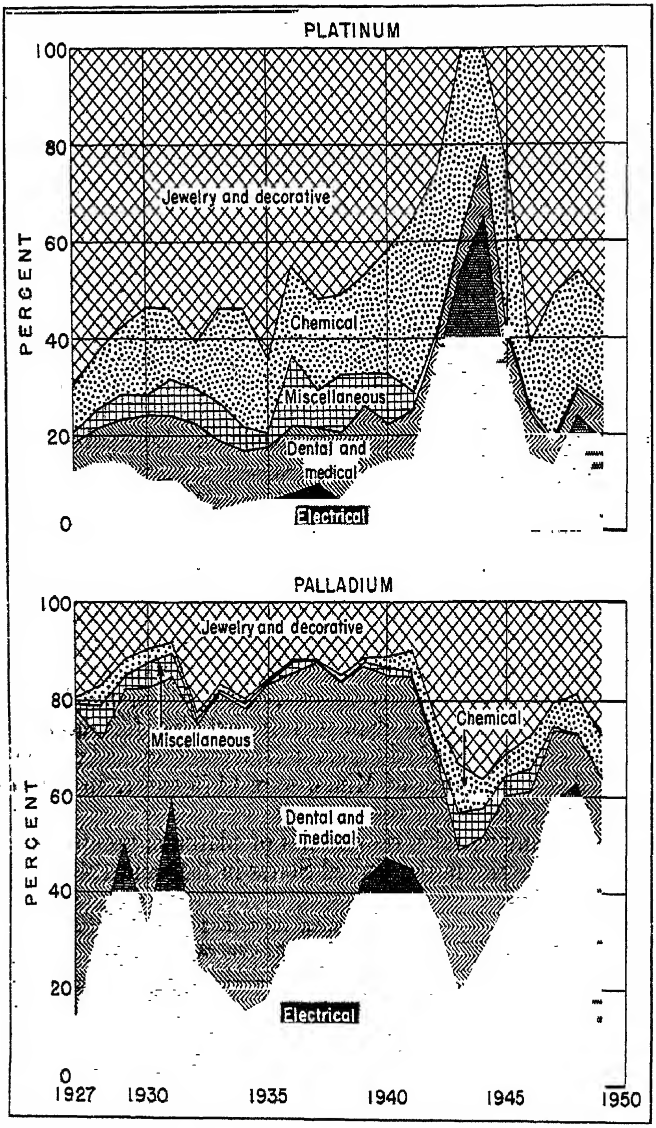

FIGURE 2.—Trend in sales of platinum and palladium to consuming industries in the United States, 1927–49, in percent.

STOCKS

Stocks of platinum-group metals in all forms in the hands of refiners, importers, and dealers totaled 296,044 ounces on December 31, 1949, compared with 323,574 ounces at the close of 1948.

Stocks of platinum-group metals held by refiners, importers, and dealers in the United States, Dec. 31, 1945–49, in troy ounces

Year	Platinum	Palladium	Iridium, osmium, rhodium, and ruthenium	Total
1945	138,839	119,757	43,376	301,972
1946	187,624	132,523	41,876	362,023
1947	133,300	167,364	36,859	337,523
1948	146,823	142,211	34,540	323,574
1949	138,049	122,408	35,587	296,044

PRICES

Buyers reported purchases at $55 to $87.25 an ounce for domestic and foreign crude platinum-group metals in 1949. This price range results chiefly from variations in iridium content of crudes and from market fluctuations for refined platinum and ruthenium in 1949.

As a result of five reductions after January 1, 1949, totaling $21, the retail prices of platinum and ruthenium reached $75 an ounce on March 17. On June 13 the quotations were reduced to $72, where they continued throughout the remainder of 1949. Iridium was quoted at $110–$115 an ounce on January 1, 1949; subsequently, three reductions were made, and on June 13 the price was $100–$105 an ounce, at which it continued throughout the remainder of 1949. Quotations on palladium, osmium, and rhodium continued unchanged at $24, $100, and $125 an ounce, respectively, throughout 1949.

FOREIGN TRADE [1]

Imports.—Imports of platinum-group metals into the United States in 1949 were 20 percent less than in 1948 and the smallest since 1940. The principal sources of imported platinum-group metals in 1949 were Canada (130,403 ounces), Colombia (26,335 ounces), United Kingdom (24,782 ounces), and Switzerland (15,148 ounces). Imports of refined metals (184,536 ounces), which comprised 85 percent of the total, were 23 percent less than in 1948, whereas those of unrefined materials (33,748 ounces) were virtually the same as in 1948. Imports of refined platinum, palladium, iridium, and osmium were 8, 39, 23, and 84 percent, respectively, less than in 1948, but imports of rhodium and ruthenium were up 30 and 33 percent, respectively.

Platinum-group metals imported for consumption in the United States, 1940–44 (average) and 1945–49

Year	Troy ounces	Value	Year	Troy ounces	Value
1940–44 (average)	307,821	$9,161,946	1947	308,865	$11,792,076
1945	383,658	11,591,390	1948	[1] 272,733	[1] 14,973,356
1946	407,210	14,696,320	1949	218,284	11,900,078

[1] Revised figure.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Platinum-group metals[1] (unmanufactured) imported for consumption in the United States, 1948–49, by countries, in troy ounces

[U. S. Department of Commerce]

Country	Unrefined materials[2]				Refined metals					Total
	Ores and concentrates of platinum metals	Grains and nuggets (including crude, dust, and residues)	Sponge and scrap	Osmiridium	Platinum	Palladium	Iridium	Osmium	Rhodium and ruthenium	
1948										
Canada	167	50	291		66,557	[3] 38,080	1,780		5,453	[3] 112,378
China		1,080	696		884					2,660
Colombia		[3] 25,140	1,014							[3] 26,154
Ethiopia	2	740								742
France			32		470					502
Israel and Jordan			42		4,204					4,246
Italy						1,011				1,011
Lebanon			64		1,977					2,041
Netherlands			193			1,000				1,193
Norway					791	451	75		1,146	2,463
Panama					217					[3] 217
Switzerland		200	267		[3] 16,127	[3] 3,819				[3] 20,413
Union of South Africa	854			216	10					1,080
U. S. S. R.						[4] 62,241	3,118	1,283		66,642
United Kingdom	797	216	235	441	11,559	[4] 13,320	499	55	2,005	29,127
Other countries	73	204	640		742	205				1,864
Total	1,893	27,630	3,474	657	[3] 103,538	[3] 120,127	5,472	1,338	8,604	[3] 272,733
1949										
Belgium-Luxembourg			6		1,948	3,345	155		895	6,349
Canada	345		593		66,583	53,761	2,101		7,020	130,403
China			775		725					1,500
Colombia	160	25,804	216		155					26,335
Egypt		359								359
Finland					105	127				232
France					2,178					2,178
Germany			33				800			833
Hong Kong					675					675
Israel and Jordan						396	25		50	471
Lebanon					3,710	225				3,935
Netherlands				900				25	84	1,009
Norway					575	390	105		280	1,350
Panama		653	28							681
Switzerland		644	49		4,272	8,720	386	130	947	15,148
Union of South Africa			2	1,737						1,739
United Kingdom		100	1,046		14,144	6,799	649	65	1,979	24,782
Other countries		43	255			7				305
Total	505	27,603	3,003	2,637	95,070	73,770	4,221	220	11,255	218,284

[1] On the basis of detailed information received by the Bureau of Mines from importers, certain items recorded by the U. S. Department of Commerce as "ores and concentrates," "grains and nuggets," and "sponge and scrap" have been reclassified and included with other groups in this table.
[2] The Bureau of Mines has determined from the largest importer of crude platinum from Colombia that the entries for his material, recorded as "platinum content" by the U. S. Department of Commerce, represent the gross weight of the material.
[3] Revised figure.
[4] Adjusted by Bureau of Mines.

Platinum-group metals[1] (unmanufactured) imported for consumption in the United States, 1948–49

[U. S. Department of Commerce]

Material	1948		1949	
	Troy ounces	Value	Troy ounces	Value
Unrefined materials:[2]				
Ores and concentrates of platinum metals	1,893	$162,573	505	$17,977
Grains and nuggets (including crude, dust, and residues)	27,630	1,787,225	27,603	1,495,446
Sponge and scrap	3,474	261,730	3,003	202,957
Osmiridium	657	45,488	2,637	231,392
Total	33,654	2,257,016	33,748	1,947,772
Refined metals:				
Platinum	[3] 103,538	[3] 8,619,789	95,070	6,881,845
Palladium	[3] 120,127	[3] 2,588,294	73,770	1,592,561
Iridium	5,472	502,327	4,221	367,968
Osmium	1,338	159,232	220	27,057
Rhodium	5,864	672,979	7,615	872,839
Ruthenium	2,740	173,719	3,640	210,036
Total	[3] 239,079	[3] 12,716,340	184,536	9,952,306
Grand total	[3] 272,733	[3] 14,973,356	218,284	11,900,078

[1] On the basis of detailed information received by the Bureau of Mines from importers, certain items recorded by the U. S. Department of Commerce as "ores and concentrates," "grains and nuggets," and "sponge and scrap" have been reclassified and included with other groups in this table.
[2] The Bureau of Mines has determined from the largest importer of crude platinum from Colombia that the entries for his material, recorded as "platinum content" by the U. S. Department of Commerce, represent the gross weight of the material.
[3] Revised figure.

Exports.—Exports of refined platinum (including scrap) increased to 18,150 ounces in 1949 (15,471 ounces in 1948), and exports of the other platinum-group metals (including scrap) increased to 22,628 ounces (20,994 ounces in 1948). In 1949 the chief foreign markets for platinum were France (6,843 ounces), Germany (6,260 ounces), Canada (983 ounces), and Cuba (904 ounces) and for the other platinum-group metals, Germany (20,136 ounces).

Platinum-group metals exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Ore and concentrates		Platinum (bars, ingots, sheets, wire, sponge, and other forms, including scrap)		Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys, including scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value
1945			7,781	$288,953	10,951	$802,843	5,906	$160,470
1946	134	$10,377	15,468	965,406	4,294	196,808	6,669	256,382
1947	42	1,322	17,766	977,468	7,783	256,150	6,327	335,797
1948	5	500	15,471	1,198,994	20,994	495,660	4,874	219,405
1949	165	1,985	18,150	1,379,976	22,628	745,349	20,702	452,824

Platinum-group metals exported from the United States, 1948–49, by countries

[U. S. Department of Commerce]

Country	Platinum (bars, ingots, sheets, wire, sponge, and other forms, including scrap)		Palladium, rhodium, iridium, osmiridium, ruthenium and osmium (metal and alloys, including scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value
1948						
Argentina	1,531	$93,063	237	$4,340	14	$1,603
Austria			1,023	22,634	16	140
Brazil	1,081	83,169	34	1,025	33	1,706
Canada	752	50,327	721	29,542	3,471	92,970
Chile	111	8,274			22	2,185
China	12	155	189	11,201	73	8,577
Colombia			135	3,638	15	708
Cuba	606	43,297	262	9,431	24	1,595
France	4,311	385,501	3,446	147,733		
Germany	2,800	227,375	12,278	229,721	32	4,175
Mexico	21	1,571	118	4,443	27	2,049
Netherlands	2	380			744	79,823
Palestine	3,513	275,700				
Philippines	196	3,451	42	1,469	30	2,036
Spain			408	10,132		
Switzerland	352	9,928	2,046	15,199	9	530
Uruguay	78	7,148				
Other countries	105	9,655	55	5,152	364	21,308
Total	15,471	1,198,994	20,994	495,660	4,874	219,405
1949						
Austria	386	28,564	20	430	25	3,265
Belgium—Luxembourg	78	6,860	96	2,170	48	1,008
Canada	983	84,037	286	24,058	19,064	385,326
China	3	118	23	1,742	131	1,780
Colombia			101	2,665	24	1,171
Cuba	904	61,269	247	5,871	50	2,787
France	6,843	472,932	340	9,489		
Germany	6,260	547,665	20,136	634,100		
Greece					90	4,729
Italy	109	8,426	86	10,255	31	1,582
Japan					708	16,745
Mexico	541	37,142	221	8,213	41	1,131
Netherlands	620	41,166	53	6,316	48	2,040
Spain			193	4,819		
Switzerland	335	22,213	102	5,166		
Tangier	64	4,656	257	6,787		
United Kingdom	642	40,980	60	3,450	25	3,100
Uruguay	221	13,344				
Venezuela	17	1,329	173	4,856	33	2,103
Other countries	144	9,275	234	14,962	384	26,057
Total	18,150	1,379,976	22,628	745,349	20,702	452,824

WORLD REVIEW

Canada.—According to the Dominion Bureau of Statistics, production of platinum-group metals from the nickel-copper ores of the Sudbury district, plus a small quantity from placers in British Columbia, was 151,317 ounces of platinum and 192,106 ounces of other platinum-group metals in 1949 compared with 121,404 ounces of platinum and 148,343 ounces of other platinum-group metals in 1948.

Sales of platinum-group metals by the International Nickel Co. of Canada, Ltd., were 214,735 ounces in 1949 compared with 199,560 ounces in 1948.

Colombia.—The South American Gold & Platinum Co. produced 20,213 ounces of crude platinum-group metals in 1949 (22,779 ounces in 1948). The crude material contains about 85 percent platinum-group metals.

World production of platinum-group metals, 1940–44 (average) and 1945–49, in troy ounces

[Compiled by Berenice B. Mitchell]

	1940–44 (average)	1945	1946	1947	1948	1949
Australia:						
New South Wales: Placer platinum	8	2	----------	----------	----------	----------
Tasmania: Placer osmiridium	202	109	95	99	92	(1)
Belgian Congo: From refineries: Palladium	----------	----------	----------	----------	209	(1)
Canada:						
Placer platinum	179,050	[2] 208,234	121,771	94,570	121,404	151,317
From refining nickel-copper matte: Platinum						
Other platinum-group metals	116,092	[2] 458,674	117,566	110,332	148,343	192,106
Colombia: Placer platinum	37,036	34,757	43,835	41,415	40,047	(1)
Ethiopia: Placer platinum	1,988	----------	[3] 140	[3] 1,548	[3] 460	[3] 355
Indonesia: Placer platinum	13	----------	----------	----------	----------	----------
Italy: From refineries: Platinum	457	----------	----------	----------	----------	(1)
New Zealand: Placer platinum	12	----------	14	----------	----------	(1)
Papua: Placer platinum [4]	1	----------	----------	----------	----------	(1)
Sierra Leone: Placer platinum	28	16	105	431	109	(1)
Union of South Africa:						
Platinum (content of platinum-group metals) from platinum ores	74,689	22,884	22,900	78,740	68,926	30,500
Concentrates (content of platinum-group metals) from platinum ores		52,030	51,900			56,800
Osmiridium from gold ores	6,685	6,259	6,794	6,402	5,520	6,031
U. S. S. R.: Placer platinum and from refining nickel-copper ores (estimate)	115,000	150,000	175,000	150,000	125,000	100,000
United States:						
Placer platinum	28,804	26,551	22,949	13,836	13,741	17,169
Ore (content of platinum-group metals)	8	----------	----------	----------	----------	----------
From refining domestic gold and copper:						
Platinum	3,820	1,068	555	1,098	1,251	1,844
Other platinum-group metals	4,458	3,427	2,808	3,472	4,261	5,794
Total (estimate)	568,300	[2] 964,000	567,000	502,000	529,000	600,000

[1] Data not available.
[2] Includes certain adjustments to account for metals produced in Canada in 1938–44 but not previously accounted for in the statistics.
[3] Exports for year ended Sept. 10 of year stated.
[4] Year ended June 30 of year stated.

Union of South Africa.—According to the Department of Mines, 1,329 tons of concentrates averaging about 42.75 ounces per ton of platinum-group metals and 120,020 ounces of crude metallics averaging 25.39 percent of platinum-group metals were produced in South Africa in 1949, compared with 1,084 tons of concentrates and 83,856 ounces of crude metallics in 1948. Thus, total output of platinum-group metals was about 87,300 ounces in 1949 compared with 68,926 ounces in 1948. The platinum-group metals are produced in the Rustenburg district and exported to England for refining.

Sales of platinum-group metals and gold from the Rustenburg district were 94,092 ounces in 1949 compared with 64,579 ounces in 1948. The proportions of the various metals of the platinum group and gold sold in 1948 were as follows:

Metal:	*Percent*	*Ounces*
Platinum	69.17	44,670
Palladium	22.03	14,230
Iridium	.47	303
Osmium and osmiridium	.09	60
Rhodium	2.57	1,658
Ruthenium	1.29	831
Gold	4.38	2,827
	100.00	64,579

South Africa is the largest producer of osmiridium in the world. It is recovered in treating gold ores on the Rand. Production was 6,031 ounces in 1949 (5,520 ounces in 1948). Sales were 6,471 ounces in 1949 (5,774 ounces in 1948). The osmiridium sold in 1948 averaged 29.08 percent osmium; 25.68 percent iridium; 12.41 percent ruthenium; 11.62 percent platinum; 0.64 percent rhodium; 2.54 percent gold; and 18.03 percent undetermined.

The work of expanding the plant of Rustenburg Platinum Mines, Ltd., continued in 1949, and certain additional units in the crushing, milling, and flotation sections were brought into operation; consequently, the tonnage of ore crushed was materially increased. Rustenburg Platinum Mines, Ltd., acquired the Union Platinum Mining Co., Ltd., on August 31, 1949. To refine the combined outputs of both mines, arrangements were made with Johnson, Matthey & Co. to expand its refinery in London.

Potash

By Bertrand L. Johnson and E. M. Tucker

GENERAL SUMMARY

A STRIKE in the potash mines of the Carlsbad district of New Mexico in November and December 1949 caused a slight reversal in the long upward trend of production and sales of potash in the United States. According to reports by producers, the output of marketable potassium salts dropped to 2,056,609 short tons, a decrease of 81,884 tons from the 1948 peak of 2,138,493 tons. (See fig. 1.) The equivalent K_2O content decreased 21,486 tons from that of the previous year. Sales likewise declined, but remained above 2,000,000 tons (2,062,789 tons), with the K_2O content (1,120,653 tons) 22,686 tons lower. Sales decreased nearly $900,000 in total value from those of 1948, but the average value per ton of the potassium salts sold in 1949 was $0.27 more than in 1948. Stocks in producers' hands at the end of 1949 reached a new low of 9,066 tons. Both imports and exports declined in quantity and value in 1949 from 1948. Apparent domestic consumption of potash (K_2O) in 1949 fell 30,475 tons from the 1948 figure.

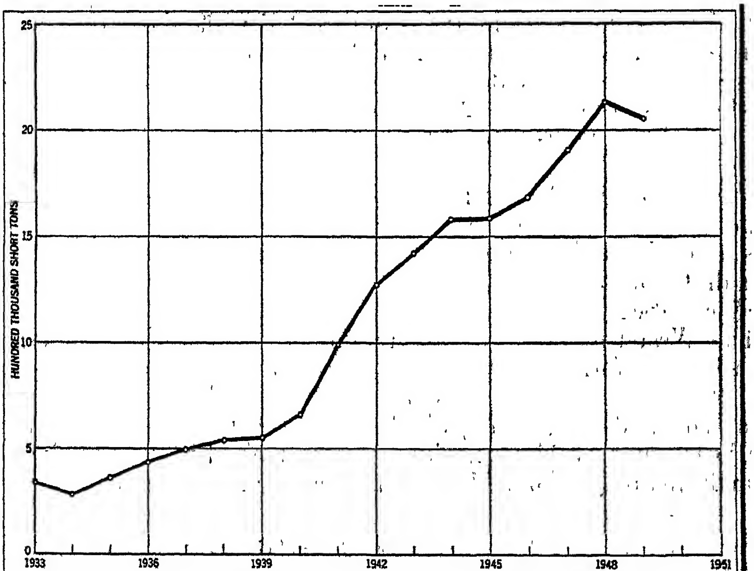

FIGURE 1.—Production of marketable potash salts in the United States, 1933–49.

Salient statistics of the potash industry in the United States, 1947–49

	1947	1948	1949
Production of potassium salts (marketable) short tons	1,905,776	2,138,493	2,056,609
Approximate equivalent K_2O do	1,029,875	1,139,881	1,118,395
Sales of potassium salts by producers do	1,953,307	2,148,807	2,062,789
Approximate equivalent K_2O do	1,053,266	1,143,339	1,120,653
Value at plant	$34,716,051	$35,998,758	$35,105,799
Average per ton	$17.77	$16.75	$17.02
Imports of potash materials short tons	51,043	52,890	43,719
Approximate equivalent K_2O do	25,978	27,181	19,216
Value	$2,475,351	[1] $3,063,547	$2,358,557
Exports of potash materials short tons	124,909	128,068	126,754
Approximate equivalent K_2O [2] do	68,102	69,733	69,557
Value	$8,686,107	$8,288,955	$7,110,054
Apparent consumption of potassium salts [3] short tons	1,879,441	2,073,629	1,979,754
Approximate equivalent K_2O do	1,011,142	1,100,787	1,070,312

[1] Revised figure.
[2] Estimate by Bureau of Mines.
[3] Quantity sold by producers, plus imports, minus exports.

Several articles on the potash industry were published in 1949.[1] A study of the domestic potash industry was included in a report on the fertilizer industry, released shortly after the end of the year by the Federal Trade Commission.[2]

PRODUCTION AND SALES

A strike in the New Mexico potash field in 1949 stopped the upward trends in the production and sales of domestic marketable potassium salts that had featured the years since 1934, and production and sales each decreased 4 percent from the 1948 figures. The output of potassium salts in 1949 totaled 2,056,609 short tons with an equivalent K_2O content of 1,118,395 tons. Sales were 2,062,789 tons, with an equivalent K_2O content of 1,120,653 tons. The value of the sales dropped $892,959 to $35,105,799. The average value per ton of the potassium salts sold in 1949 was $17.02, $0.27 more than 1948.

Production of 60–62-percent-K_2O minimum grade of the muriate of potash and of manure salts was less in 1949 than in 1948, but there was a considerable increase in the lower-grade muriate. Production of sulfate of potash and sulfate of potash-magnesia continued to decline. (See fig. 2.)

The Western States remain dominant in domestic production of potash. California, New Mexico, and Utah furnished virtually all of the 1949 output, the largest part coming from deeply buried deposits of sylvite and langbeinite, of Permian age, in the Carlsbad region, southeastern New Mexico. The eastern United States supplied only a small quantity—from Maryland, Michigan, and Pennsylvania.

[1] Turrentine, J. W., Some Statistics of the American Potash Industry: Am. Potash Inst., Washington, D. C., 1949, 13 pp.
Ware, Tom, Potash Mining: Min. Cong. Jour., vol. 36, No. 2, February 1950, pp. 104–105.
Turrentine, J. W., The Development of the American Potash Industry: Better Crops with Plant Food, vol. 33, No. 3, March 1949, pp. 6–14, 40–42.
Turrentine, J. W., Potash Production—a Progress Report: Better Crops with Plant Food, vol. 34, No. 4, April 1950, pp. 12–16, 40–42.
[2] Federal Trade Commission, Report on the Fertilizer Industry: Submitted to Congress Jan. 9, 1950, Washington, D. C., 1950, 176 pp.

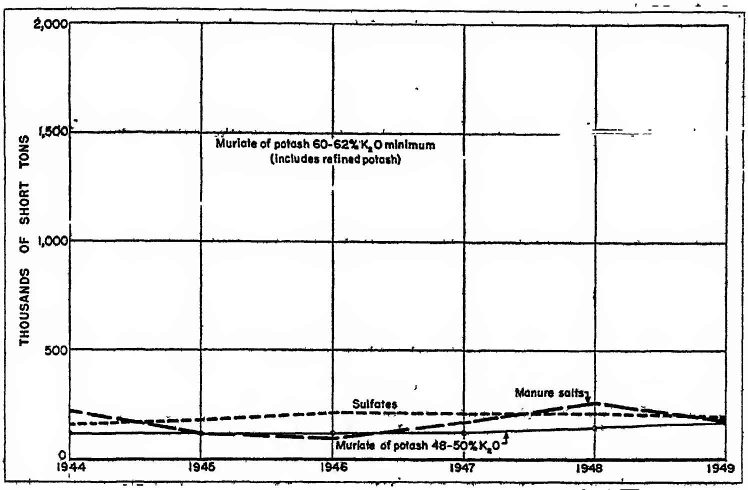

FIGURE 2.—Potassium salts produced in the United States, 1944–49, by grades, in short tons.

Potassium salts produced in the United States, 1947–49, by grades, in short tons

Grade	1947	1948	1949
Muriate of potash:			
60–62 percent K_2O minimum [1]	1,394,202	1,523,937	1,513,128
48–50 percent K_2O minimum	125,120	145,675	172,475
Manure salts	174,145	260,339	177,315
Sulfate of potash and sulfate of potash-magnesia	212,309	208,542	193,691
Total	1,905,776	2,138,493	2,056,609

[1] Includes refined potash and some 93–96 percent KCl.

Potassium salts produced, sold, and in producers' stocks in the United States, 1945–49

Year	Production			Sales				Producers' stocks, Dec. 31	
	Operators	Potassium salts (short tons)	Equivalent potash (K_2O) (short tons)	Operators	Potassium salts (short tons)	Equivalent potash (K_2O) (short tons)	Value f. o. b. plant	Potassium salts (short tons)	Equivalent potash (K_2O) (short tons)
1945	7	1,588,305	874,243	6	1,597,160	870,370	$30,313,919	68,796	34,253
1946	7	1,687,735	931,812	7	1,673,249	928,374	32,175,716	82,554	37,999
1947	7	1,905,776	1,029,875	7	1,953,307	1,053,266	34,716,051	35,428	14,697
1948	7	2,138,493	1,139,881	7	2,148,807	1,143,339	35,998,758	26,093	11,211
1949	8	2,056,609	1,118,395	8	2,062,789	1,120,653	35,105,799	18,913	9,066

The potash-producing companies in the United States in 1949, by States, were as follows:

California:
The American Potash & Chemical Corp., 3030 West Sixth Street, Los Angeles 54, Calif. (plant at Trona, on Searles Lake, Calif.).

Maryland:
North American Cement Corp., 41 East Forty-Second Street, New York, N. Y. (plant at Security, Md.).

Michigan:
The Dow Chemical Co., Midland, Mich. (brine wells and plant near Midland, Mich.).

New Mexico:
International Minerals & Chemical Corp., 20 North Wacker Drive, Chicago, Ill. (mine and plant near Carlsbad, N. Mex.).
Potash Company of America, Carlsbad, N. Mex. (mine and plant near Carlsbad, N. Mex.).
United States Potash Co., Inc., 30 Rockefeller Plaza, New York, N. Y. (mine and plant near Carlsbad, N. Mex.).

Pennsylvania:
Publicker Industries, Inc., 1429 Walnut Street, Philadelphia 2, Pa.

Utah:
Bonneville, Ltd., 540 West Seventh South, Salt Lake City 4, Utah (plant near Wendover, Utah).

REVIEW BY STATES

California.—The American Potash & Chemical Corp. continues to be the only potash-producing company operating in the Pacific Coast States. A potash-bearing brine was pumped from the saturated crystalline salt mass of Searles Lake in southeastern California. Potassium chloride and potassium sulfate are marketed. Deep-drilling operations are reported to have increased the known reserves of potash at this property.[3]

Maryland.—Maryland has but one producing potash company, the North American Cement Corp., which at its plant at Security, Washington County, near Hagerstown, recovers byproduct potash from cement-kiln flue dust. The product—an impure sulfate of potash of low potash content—was sold for agricultural use. This operation was the only one of its kind reported in the United States in 1949.

Michigan.—The Dow Chemical Co. was the only potash-producing company in Michigan in 1949. Potassium chloride was produced from its natural brine wells at Midland, Mich.

New Mexico.—Mine production of potassium salts in the Carlsbad region of New Mexico declined 5 percent in 1949 from 1948, as a result of a year-end strike. The three companies operating in this area in 1949 mined 4,852,903 short tons of sylvinite and langbeinite combined—a decrease of 255,469 tons from 1948. The equivalent K_2O content of the mined production in 1949 was 1,018,886 short tons. The average equivalent K_2O content of the mined salts increased from 20.94 percent in 1948 to 21.00 percent in 1949.

All three of the producing companies—International Minerals & Chemical Corp., Potash Company of America, and the United States Potash Co.—mined sylvite (potassium chloride) and one—International Minerals & Chemical Corp.—also mined langbeinite (a potassium-magnesium sulfate). The greater part of the mine production of the region was sylvite, most of which was processed to yield 60-percent or higher-grade muriate. The production of merchantable potash salts in New Mexico in 1949 was 1,733,739 short tons, with an equivalent K_2O content of 927,621 tons. Sales were 1,744,427 tons of salts (932,497 tons K_2O) valued at $27,950,111. Muriate of potash was produced by all three companies. Potassium sulfate and potassium-magnesium sulfate (sulfate of potash-magnesia) were pro-

[3] Taylor, Frank J., The World's Richest Mineral Stock Pile: Saturday Evening Post, Mar. 5, 1949, pp. 26–27, 68, 70, 72.

duced from langbeinite by the International Minerals & Chemical Corp. in the refinery at its mine near Carlsbad.

The strike previously referred to was called on November 19, 1949, by C. I. O. Mine, Mill, and Smelter Workers' Union Local 415 at the three potash-producing plants of the Carlsbad region, and output and shipments stopped. The strike continued until January 31, 1950, but some potash was produced and shipped during the latter part of January.[4] A little is said to have been moved from one of the refineries in December.

Several papers regarding developments in the potash industry of New Mexico in 1949 have appeared recently.[5]

The International Minerals & Chemical Corp. completed an extensive development program which included a new refinery for the production of chemical-grade potassium chloride and a higher-grade potassium sulfate. The capacity of this plant at full production is expected to be over 22,000 tons KCl annually and 60,000 tons K_2SO_4 per year. The equipment installed includes agitators, Ozark evaporators, heaters, vacuum crystallizers, Bird centrifuges, and a rotary drier. Plant feed is 60-percent-grade sylvite concentrate. The mother liquor goes to the base-exchange plant, where potassium sulfate is produced by base exchange of sylvite and langbeinite. Other improvements at the surface include the replacement of vacuum filters handling flotation concentrates by Bird continuous centrifuges that deliver a lower-moisture feed to gas-fired rotary driers. International is now installing a 400-kv.-a. automatic starting and running Diesel generator set for use in case of power supply failure. The company's present main Diesel plant is to be shut down, and all power in future is to be supplied by the Southwestern Public Service Co. Underground, some Diesel equipment such as bulldozers is in use. The company is testing the effect of pillar robbing in a mined-out panel on the 900-foot level.

During 1949 the Potash Company of America completed the expansion and improvement program begun early in 1948 for the production of potassium chloride. Improvements are stated to include a 26-mile pipe line for fresh-water supply, the addition of two large grinding mills, a Symons cone crusher, six cooling agitator plants, a 24-cell flotation section, a 1,000-hp. hoist, and all-steel dump cars. Construction is expected to be started in 1950 on a plant for the production of potassium sulfate and hydrochloric acid. The No. 4 shaft is reported to have been practically completed in December 1949.

[4] Engineering and Mining Journal, The Carlsbad Strike: Vol. 151, No. 4, April 1950, pp. 77–78, 80.

[5] Barr, J. A., New Developments at Carlsbad: Min. Cong. Jour., vol. 36, No. 2, February 1950, pp. 105–106, 122.

Cathcart, J. B., Open Fracture in Langbeinite, International Minerals & Chemical Corp.'s Potash Mine, Eddy County, N. Mex.: Am. Inst. Min. and Met. Eng., Min. Trans., vol. 184, July 1949, pp. 256–258.

Wrege, E. E., and Dancy, W. B., Quality by the Ton: Chem. Ind., vol. 65, No. 1, July 1949, pp. 46–49. (A description of the new plant of the International Minerals & Chemical Corp., near Carlsbad, N. Mex.)

Harley, G. T., and Storms, W. R., Mining Methods and Practices at International Minerals & Chemical Corp. Potash Mine, Eddy County, N. Mex.: Bureau of Mines Inf. Circ. 7511, 1949, 21 pp.

Haworth, R. G., Mining Potash Ores in Carlsbad Area: Am. Inst. Min. and Met. Eng., Min. Trans., vol. 184, November 1949, pp. 381–382.

Pierce, Jack, Potash: Eng. and Min. Jour., vol. 151, No. 2, February 1950, pp. 100–101.

Smith, J. P., Geologic Setting for Potash Deposits in Southeast New Mexico. Paper read at Am. Inst. Min. and Met. Eng. meeting, Los Angeles, Calif., October 1949, 4 pp. (mimeo.).

Pierce, Jack, Carlsbad Potash Industry Expands: Eng. and Min. Jour., vol. 150, No. 7, July 1949, pp. 134–135.

The productive capacity of the United States Potash Co. plant is reported to be considerably increased by the expansion program currently being carried out. A crystal refining unit has been added to its Loving, N. Mex., plant.

The Central Farmers' Fertilizer Co., a cooperative, did considerable drilling in the southern part of the Carlsbad potash field.

The Duval Texas Sulphur Co., a subsidiary of the United Gas Corp., drilled extensively in the southern and northern parts of this field. Potassium sulfate ores were found in the southern area. Workable sylvite deposits were outlined by the drilling on Government land in the northern part of the area between the mines of the Potash Company of America and the United States Potash Co. Plans have been made to lease the ground and mine the potash salts.

The Freeport Sulphur Co. is said to have acquired control of the Cross interests, leases, and permits. The latter have been conducting solution-type mining tests but have discontinued work with no commercial results reported.

The Southwest Potash Co., a wholly owned subsidiary of the American Metal Co., Ltd., is core-drilling leased holdings in the Carlsbad potash area, approximately six miles north of the operations of the Potash Company of America. An area of good-grade sylvinite is reported to have been outlined.

Pennsylvania.—The Publicker Industries, Inc., reports the recovery in 1949 of a low-potash-content potassium sulfate from molasses residues at their Bigler Street distillery in Philadelphia. This by-product potash material was sold for use as a fertilizer ingredient.

Utah.—Commercial production of potash in Utah in 1949 was restricted to the operations of Bonneville, Ltd., which continued to produce potassium chloride from the potassium-bearing brines of Salduro Marsh, at its plant near Wendover, Tooele County, northwestern Utah.

There was no development work in progress in 1949 in the potash-bearing area in Grand County in eastern Utah. Prospecting for potash in this region continued in connection with oil-well drilling. Two wells—one of the Tidewater Associated Oil Co., 8,300 feet deep, near Moab, and the other of the Pacific Western Oil Co., 13,766 feet deep, drilled about 6 miles east of the Thompson well—were partly cored and the cores tested for potassium.

A report [6] of drilling, by the Bureau of Mines and Geological Survey, of the Defense Plant Corporation, Utah Magnesium Corp., Reeder No. 1 well, near Thompson, Utah, in 1942, was published in 1949. A detailed log of the well is given and also a table showing chemical and mineralogical analyses of numerous core samples.

There was no production of alunite in the Marysvale district.

CONSUMPTION

Apparent consumption of potash (K_2O) in the United States and its possessions decreased from 1,100,787 short tons in 1948 to 1,070,312 tons in 1949, as determined by subtracting exports from the sum of the imports and the producers' sales. The relationship of the apparent

[6] Severy, C. L., Kline, M. H., and Allsman, P. T., Investigations of the Thompson Magnesium Well, Grand County, Utah: Bureau of Mines, Rept. of Investigations 4496, 1949, 21 pp.

consumption to the sales of domestic producers, as reported to the Bureau of Mines, for a period of years is shown in figure 3.

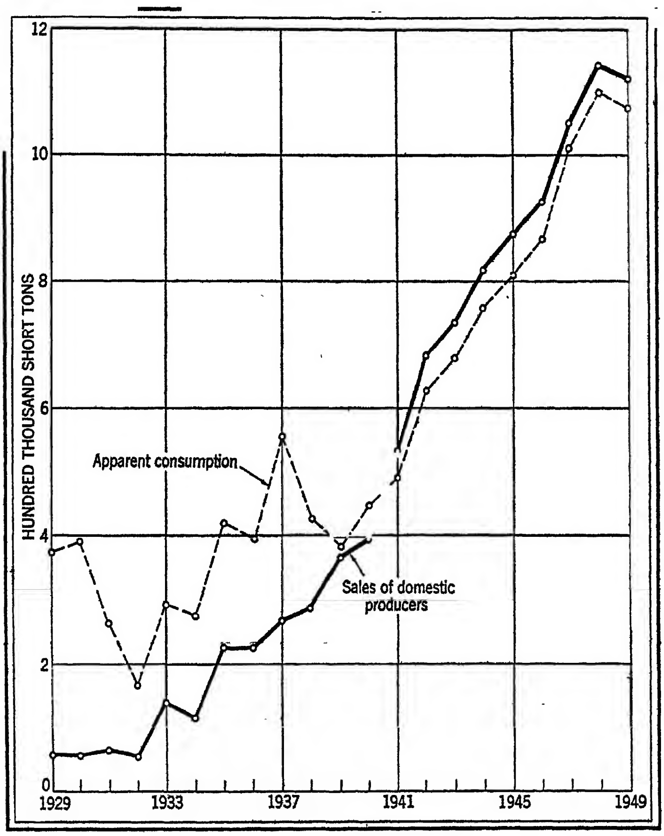

FIGURE 3.—Comparison of apparent domestic consumption of potash (K_2O) and sales by domestic producers of potash in the United States, 1929–49.

Apparent consumption[1] of potash in the United States, 1945–49. in short tons

Year	Potassium salts	Approximate equivalent K_2O	Year	Potassium salts	Approximate equivalent K_2O
1945	1,490,112	808,688	1948	2,073,629	1,100,787
1946	1,568,721	867,096	1949	1,979,754	1,070,812
1947	1,879,441	1,011,142			

[1] Quantity sold by producers, plus imports, minus exports.

According to the American Potash Institute (press notice February 1, 1950):

Deliveries of potash in North America during 1949 by the five leading producers and two importers amounted to 2,104,820 [short] tons of potash salts containing an equivalent of 1,145,793 tons K_2O. This was a decrease of 28,049 tons K_2O or 2.4 percent under 1948, due to a strike of potash miners in the Carlsbad area

beginning November 19, 1949, and continuing past the end of the year. Prior to that date, deliveries in 1949 had been running well ahead of last year. Included in the above figures are 65,912 tons of salts of French origin with an equivalent of 40,126 tons K_2O. There were no importations of German potash during the calendar year.

Deliveries for agricultural purposes in the continental United States for 1949 were 972,154 tons K_2O, a decrease of 5,227 tons under 1948. Canada received 65,028 tons K_2O, Cuba 5,151 tons, Puerto Rico 14,320 tons, and Hawaii 11,535 tons. Exports to other countries amounted to 11,040 tons K_2O.

In this country the potash was delivered in 45 States and the District of Columbia. Ohio with over 90,000 tons K_2O was the leading State in deliveries of agricultural potash and was followed in order by Georgia, Illinois, North Carolina, Virginia, and Florida, each taking more than 60,000 tons K_2O during the year. Due to shipments across State lines, consumption does not necessarily correspond to deliveries within a State.

The 60 percent muriate of potash continues to be by far the most popular material, comprising 81 percent of the total K_2O delivered for agricultural purposes. The 50 percent muriate of potash made up 8 percent, manure salts 4 percent, and sulphate of potash and sulphate of potash-magnesia 7 percent of the deliveries. With increased refining capacity brought into production during the year, a greater proportion of the deliveries was in the form of the more concentrated forms, with a falling off in manure salts.

Deliveries [in North America] for chemical purposes in 1949 were 101,283 tons of muriate of potash containing an equivalent of 63,409 tons K_2O, and 6,230 tons of sulphate of potash containing 3,156 tons K_2O. The total chemical deliveries of 66,565 tons K_2O were 21,461 tons or 24 percent less than in 1948.

Deliveries of agricultural and chemical potash in North America from 1939 to 1949 are shown in the accompanying diagram (fig. 4).

Deliveries of potash salts in 1949, by States of destination, in short tons of K_2O

[American Potash Institute]

State	Agricultural potash	Chemical potash	State	Agricultural potash	Chemical potash
Alabama	42,333	27	Nebraska	261	31
Arizona	956	----------	Nevada	----------	1,862
Arkansas	19,873	----------	New Hampshire	54	----------
California	13,443	3,146	New Jersey	31,142	1,755
Colorado	937	----------	New Mexico	373	----------
Connecticut	4,182	150	New York	16,997	44,278
Delaware	4,538	572	North Carolina	67,045	----------
District of Columbia	125	----------	North Dakota	1,173	----------
Florida	62,226	----------	Ohio	90,688	1,533
Georgia	83,192	325	Oklahoma	836	303
Idaho	257	----------	Oregon	3,104	503
Illinois	78,547	1,122	Pennsylvania	18,806	573
Indiana	56,471	39	Rhode Island	86	----------
Iowa	13,551	237	South Carolina	47,660	----------
Kansas	779	573	Tennessee	30,986	689
Kentucky	13,783	50	Texas	9,655	1,910
Louisiana	19,055	----------	Utah	115	21
Maine	13,993	----------	Vermont	580	----------
Maryland	47,168	2,142	Virginia	64,645	703
Massachusetts	11,681	102	Washington	3,699	----------
Michigan	17,961	573	West Virginia	347	2,808
Minnesota	16,634	----------	Wisconsin	25,707	----------
Mississippi	22,755	20			
Missouri	13,632	204	Total	972,154	66,251
Montana	123	----------			

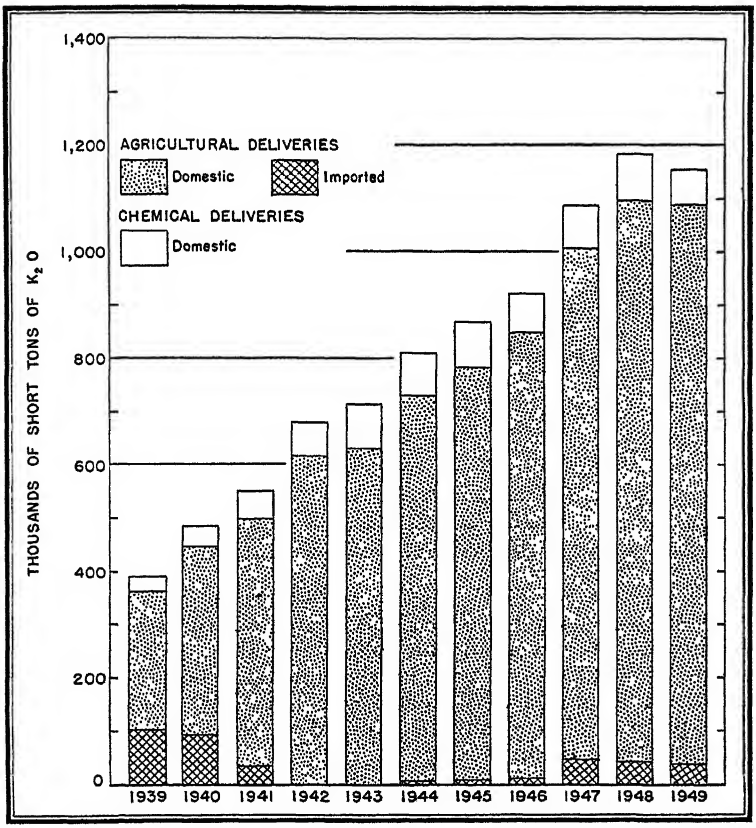

FIGURE 4.—Potash deliveries, by use groups, in North America, 1939-49 (American Potash Institute).

STOCKS

Continuing demand for potash in 1949 and interruption of mining operations toward the end of the year resulted in a decline of producers' stocks to the lowest point since 1942. The trend is presented graphically in figure 5, and precise data for 1945–49 are included in the third table of this chapter.

PRICES

Prices for potash in the early part of 1949 were those listed in the producers' price schedules for the 1948–49 season. (See Minerals Yearbook, 1948, p. 1062.)

On May 6, 1949, the American Potash & Chemical Corp. issued its price schedule for Trona potash for the 1949–50 season. Its list price of muriate of potash, 60 percent K_2O minimum, f. o. b. Trona, Calif., bulk, in carlots of not less than 40 tons, was retained at 45.5 cents per unit K_2O, with an additional charge for shipments in bags. The seasonal discounts were the same as for 1948–49. The list price of sulfate was continued at 79 cents per unit K_2O.

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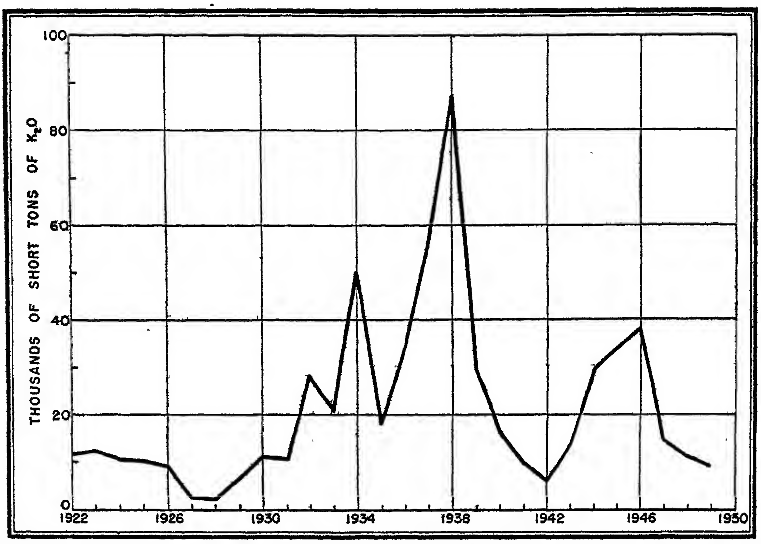

FIGURE 5.—Equivalent potash (K_2O), content in producers' stocks at end of year, 1922–49, in short tons.

Price schedules for New Mexico potash for agricultural purposes for 1949–50 were issued in April and May 1949 by the three producing companies, as given in the following table. The only change from the 1948–49 prices was in the muriate, 60-percent granular grade, which is priced at 39 cents per unit K_2O compared with a previous price of 37.5 cents; the upward revision was made to cover the increased cost of processing.

Prices of agricultural potash quoted by producers, f. o. b. Carlsbad, N. Mex., for 1949–50 season [1]

Salt	Grade	Brand	Producer	Price
Muriate of potash	62–63 percent K_2O	Sunshine State	U. S. P	37.5 cents per unit K_2O.
Do	60 percent K_2O minimum, standard.	Red Muriate	P. C. A	Do.
Do	60 percent K_2O minimum	International	I. M. & C	Do.
Do	60 percent K_2O minimum, granular.	Red Muriate	P. C. A	39 cents per unit K_2O.
Do	48–50 percent K_2O, granular.	Sunshine State	U. S. P	37.5 cents per unit K_2O.
Do.[2]	50 percent K_2O minimum	International	I. M. & C	Do.
Manure salts	22 percent K_2O minimum	Red Muriate	P. C. A	20 cents per unit K_2O.
Do	Run-of-mine 20 percent K_2O minimum.	Sunshine State	U. S. P	Do.
Sulfate of potash	90–95 percent K_2SO_4, basis 90 percent K_2SO_4.	International	I. M. & C	$32.50 per short ton.
Sulfate of potash-magnesia.	Basis 40 percent K_2SO_4, 18.50 percent MgO.	International Sul-po-mag.	do	$14.50 per short ton.

[1] Bulk in carlets (minimum 40 tons). Subject to seasonal discounts.
[2] International Minerals & Chemical Corp. quoted muriate of potash, 50–51 percent K_2O, packed in 5-ply plain paper bags, 100 pounds each, at $23 per short ton.

At the end of 1949 interest increased in cottonseed-hull ash, and sales were reported at $1.75 per unit of potash in bags, carlots, delivered. Ground cottonbur ash, a source of carbonate of potash, was offered in December 1949 at around 75 cents per unit of potash (K_2O) in bulk, f. o. b. cars, Texas shipping point.

Sales of imported French muriate of potash were reported in trade journals during 1949 at 65 cents per unit K_2O, ex vessel Atlantic ports for November–April shipments. Some muriate of potash and sulfate of potash from the American zone in Germany is said to have been offered for shipment, the muriate at 80 cents per unit and the sulfate at $48 per ton ex vessel, Atlantic or Gulf ports.

FOREIGN TRADE [7]

Imports.—Total imports of potash salts in 1949 were considerably smaller than in 1948, dropping to only 43,719 short tons (19,216 tons K_2O) owing to decreased arrivals of potassium-bearing fertilizer materials. The total value of the imports also declined, falling from $3,063,547 in 1948 to $2,358,557 in 1949. France, Chile, and Algeria, in the order given, were the principal supplying countries in 1949. None is reported to have come from Russia.

Potash for fertilizer use constituted 92 percent of the total K_2O imports in 1949, 4 percent less than in the previous year. Imports for chemical use rose from 4 percent in 1948 to 8 percent of the total in 1949.

The principal potash salt imported in 1949 for fertilizer use was muriate (chloride), which entered from France and Canada. A little potassium sulfate (631 tons) came from Germany. Chile supplied 6,802 tons (952 tons K_2O) of crude sodium-potassium nitrate mixtures, whereas none had entered the previous year. Imports of potassium bitartrate were considerably greater than in the previous year and formed 96 percent of the total imports for chemical use.

[7] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Potash materials imported for consumption in the United States, 1948–49, by countries, in short tons[1]

[Figures in parentheses in column headings indicate, in percent, approximate equivalent as potash (K_2O)]

[U. S. Department of Commerce]

Country	Caustic (hydroxide) (80)	Muriate (chloride) (56.4)	Bitartrate: Argols or wine lees (20)	Bitartrate: Cream of tartar (25)	Potassium sulfate, crude (50)	Potassium sodium nitrate mixtures, crude (14)	Chlorate and perchlorate (36)	All other[2]	Total: Short tons	Total: Value
1948										
Algeria			882						882	$77,736
Canada		1,032						106	1,138	58,773
Chile			22				42		64	11,879
China								4	4	2,118
Czechoslovakia								6	6	924
Denmark								(3)	(3)	15
France		17,872	11					(3)	17,883	807,974
Germany		2,425			11,805				14,230	695,994
Hong Kong								(3)	(3)	89
Italy			3,480	242					3,722	436,919
Morocco, French			167						167	21,418
Portugal			246	23					269	35,068
Spain		(3)		95					95	42,153
Sweden	90								90	37,068
Tunisia			10						10	10,890
U. S. S. R.		14,275							14,275	780,142
United Kingdom								55	55	44,387
Total	90	35,604	4,818	360	11,805		42	171	52,890	3,063,547
1949										
Algeria			2,943						2,943	240,392
Belgium-Luxembourg								6	6	1,949
Canada	(3)	1,049	2				2	23	1,076	52,315
Chile			66			6,802	101	1	6,970	337,932
China		(3)						3	3	1,707
Czechoslovakia								6	6	924
France		28,077	1,524					1	29,602	1,342,697
Germany					631			29	660	37,683
Italy			927	226					1,153	190,377
Morocco, French			497						497	35,884
Norway								(3)	(3)	35
Portugal			400	10					410	38,433
Spain				87					87	27,228
Sweden	36							33	69	19,410
Switzerland							55		55	7,683
Tunisia			165						165	11,091
United Kingdom								17	17	12,817
Total	36	29,126	6,524	323	631	6,802	158	119	43,719	2,358,557

[1] Revisions for 1947 in Minerals Yearbook, 1948, p. 1064, should read: Muriate (chloride) imported from Belgium-Luxembourg, none; France, 33,388 tons; total, Belgium-Luxembourg, 6 tons, value, $5,641; France, 33,506 tons, $1,242,855.

[2] Approximate equivalent as potash (K_2O)—1948: 44 percent; 1949: 35 percent.

[3] Less than 1 ton.

Potash materials imported for consumption in the United States, 1948–49

[U. S. Department of Commerce]

Material	Approximate equivalent as potash (K_2O) (percent)	1948				1949			
		Short tons	Approximate equivalent as potash (K_2O)		Value	Short tons	Approximate equivalent as potash (K_2O)		Value
			Short tons	Percent of total			Short tons	Percent of total	
Used chiefly in fertilizers:									
Manure salts	31.4	43	14	0.1	$1,938	-------	-------	-------	-------
Muriate (chloride)	56.4	35,604	20,081	73.9	1,736,324	29,126	16,427	85.5	$1,226,863
Potassium nitrate, crude	40.0	(1)	(1)	-------	43	1	(1)	-------	43
Potassium-sodium nitrate mixtures, crude	14.0	-------	-------	-------	-------	6,802	952	4.9	310,343
Potassium sulfate, crude	50.0	11,805	5,903	21.7	599,722	631	316	1.6	34,000
Other potash fertilizer material [2]	6.0	63	4	-------	2,415	23	1	-------	399
Total fertilizer	-------	47,515	26,002	95.7	2,340,442	36,583	17,696	92.0	1,571,648
Used chiefly in chemical industries:									
Bicarbonate	46.0	6	3		924	12	6		2,253
Bitartrate:									
Argols	20.0	4,818	964		485,949	6,524	1,305		586,338
Cream of tartar	25.0	360	90		143,396	323	81		129,606
Carbonate	61.0	4	2		2,157	3	2		1,624
Caustic	80.0	90	72	4.3	37,197	36	29	8.0	14,412
Chlorate and perchlorate	36.0	42	15		9,073	158	57		29,360
Cyanide	70.0	25	18		11,204	-------	-------		-------
Ferricyanide	42.0	11	5		16,692	1	(1)		1,186
Nitrate	46.0	(1)	(1)		150	6	3		1,717
Permanganate	29.0	-------	-------		-------	(1)	(1)		52
All other	50.0	19	10		[3] 16,363	73	37		20,361
Total chemical	-------	5,375	1,179	4.3	[3] 723,105	7,136	1,520	8.0	786,909
Grand total	-------	52,890	27,181	100.0	[3] 3,063,547	43,719	19,216	100.0	2,358,557

[1] Less than 1 ton.
[2] Chiefly wood ashes from Canada.
[3] Revised figure.

Exports.—The total value of the export trade in potash materials declined in 1949 from the previous year, dropping from $8,288,955 in 1948 to $7,110,054. The value of the exports of potash fertilizers has increased each year since 1946 and in 1949 reached $3,818,006, but the latest increase of 1949 over 1948 did not compensate for the decrease of nearly $1,500,000 in the value of potash chemicals exported in 1949. The exports of both fertilizer and chemical potash salts were widely distributed. The fertilizer materials (111,156 short tons, containing 61,914 tons K_2O) went mainly to Canada, with much smaller quantities to numerous other countries, mainly in the Western Hemisphere. The exports of chemical potash salts (15,598 tons, containing 7,643 tons K_2O) were more uniformly distributed. Canada and Hong Kong were the leading recipients, but large quantities went to Brazil, Italy, and Mexico.

Potash materials exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Fertilizer		Chemical		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	104,687	$2,986,990	18,966	$3,648,795	123,653	$6,635,785
1946	96,822	2,983,751	23,905	5,055,441	120,727	8,039,192
1947	102,939	3,251,645	21,970	5,434,462	124,909	8,686,107
1948	104,176	3,498,240	23,892	4,790,715	128,068	8,288,955
1949	111,156	3,818,006	15,598	3,292,048	126,754	7,110,054

Potash materials exported from the United States, 1948–49, by countries of destination

[U. S. Department of Commerce]

Country	Fertilizer				Chemical			
	1948		1949		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Argentina	50	$3,375			780	$187,758	29	$12,107
Australia					899	142,845	202	40,000
Austria					237	71,792	320	85,824
Barbados	3,614	161,116	4,133	$165,445				
Belgium-Luxembourg					1,899	387,099	503	89,465
Brazil	9,873	464,045	10,407	456,726	1,804	357,111	1,157	278,544
Canada	73,500	2,186,206	76,085	2,389,830	4,711	590,942	2,971	458,014
Chile					119	35,460	84	26,835
China					1,261	317,647	486	115,743
Colombia	1,058	41,661	1,197	45,020	1,033	216,977	464	118,008
Cuba	8,294	295,820	12,723	496,574	215	55,823	130	39,796
Denmark					147	29,301	140	25,550
Dominican Republic	1,070	64,367	400	17,066	55	7,359	16	3,649
Germany					871	201,440	729	171,160
Greece					138	39,372	209	68,603
Guatemala	1	95	14	966	104	24,871	118	29,371
Hong Kong					675	152,123	2,131	410,874
Iceland	849	39,576			13	3,188	9	2,634
India					1,101	218,343	271	76,432
Italy					1,433	254,103	1,298	221,412
Jamaica	1,453	60,496	857	39,744	15	3,810	10	2,371
Leeward Islands	961	40,081	531	22,530			1	412
Mexico	1,451	46,398	1,536	43,511	1,029	278,548	1,064	288,585
Netherlands					1,670	329,456	155	42,206
New Zealand					58	10,280	9	2,412
Norway					75	21,237	34	10,930
Peru					82	27,563	67	20,284
Philippines	529	26,616	1,659	66,048	77	23,102	118	33,113
Portugal	15	1,440			131	29,340	17	4,494
Sweden					89	30,558	180	16,535
Switzerland			55	2,151	1,299	255,636	407	79,139
Trinidad and Tobago	221	10,444	674	30,223	11	2,243	1	260
Turkey					294	55,230	808	122,331
Union of South Africa					424	101,830	414	64,807
United Kingdom					158	37,072	2	1,978
Uruguay	348	13,661	100	4,068	86	28,162	27	8,766
Venezuela	551	29,231	141	10,618	133	45,565	180	49,003
Yugoslavia					1	369	1	656
Other countries	338	13,612	644	27,486	765	222,160	841	269,745
Total	104,176	3,498,240	111,156	3,818,006	23,892	4,790,715	15,598	3,292,048

WORLD REVIEW

Available statistics of potash output in the various producing countries, as well as estimated totals of world production, are shown in the accompanying table.

Two articles summarizing the world potash situation have been published recently.[8]

World production of potassium salts, by countries, 1944–49, in metric tons [1]

[Compiled by Helen L. Hunt]

Country [1] and kind of salt	1944		1945		1946	
	Potassium salts	Equivalent K_2O	Potassium salts	Equivalent K_2O	Potassium salts	Equivalent K_2O
North America: United States	1,431,982	757,103	1,440,879	793,096	1,531,079	845,321
Europe:						
France (Alsace), crude	2,951,355	466,657	855,730	144,701	3,558,760	574,495
Germany, crude (carnallite, kieserite, kainite, sylvinite, and hartsalz)	15,861,933	1,925,530	(2)	(2)	(2)	955,400
Spain, crude (salable)	675,836	194,284	710,496	269,795	365,207	136,541
Asia:						
China	1,732	(2)	(2)	(2)	(2)	(2)
India, nitrate of potash [3]	2,152	1,118	7,587	3,759	3,512	1,727
Israel-Jordan [4]	105,050	52,500	93,625	46,800	90,571	45,300
Japan, alunite	--------	--------	--------	--------	--------	--------
Korea, alunite	18,411	(2)	(2)	(2)	(2)	(2)
Australia:						
New South Wales, alunite	640	48	641	48	727	54
Western Australia, alunitic mud	19,545	303	21,975	414	35,700	529
Total (estimate)	--------	3,450,000	--------	2,370,000	--------	2,700,000

Country [1] and kind of salt	1947		1948		1949	
	Potassium salts	Equivalent K_2O	Potassium salts	Equivalent K_2O	Potassium salts	Equivalent K_2O
North America: United States	1,728,882	934,282	1,939,998	1,034,077	1,865,715	1,014,586
Europe:						
France (Alsace), crude	4,168,725	632,844	4,461,174	769,000	(2)	[5][6] 900,000
Germany, crude (carnallite, kieserite, kainite, sylvinite, and hartsalz)	(2)	[5][6] 1,050,000	(2)	[5][6] 1,340,000	(2)	[5][6] 1,280,000
Spain, crude (salable)	622,153	195,892	992,743	151,185	(2)	(2)
Asia:						
China	1,000	(2)	(2)	(2)	(2)	(2)
India, nitrate of potash [3]	(2)	(2)	(2)	(2)	(2)	(2)
Israel-Jordan [4]	123,163	61,600	(2)	29,700	--------	--------
Japan, alunite	2,259	(2)	1,984	(2)	3,544	(2)
Korea, alunite	(2)	(2)	(2)	(2)	(2)	(2)
Australia:						
New South Wales, alunite	406	30	712	53	(2)	(2)
Western Australia, alunitic mud	34,882	572	39,759	652	[7] 24,194	[7] 400
Total (estimate)	--------	3,000,000	--------	3,500,000	--------	3,600,000

[1] In addition to countries listed, Chile, Ethiopia, Iran, Italy, Poland, and U. S. S. R. are reported to produce potash salts, but statistics of production are not available; estimates by senior author of chapter included in total. (Estimate for Chile included only for the year 1949.)
[2] Data not available; estimate by author of the chapter included in total.
[3] Exports plus consumption, 1944–46.
[4] Production in fiscal years 1944–48 represents Palestine. Extracted from waters of Dead Sea.
[5] Estimate.
[6] Fiscal year ended June 30 of year stated.
[7] January to September, inclusive.

Australia.—An illustrated article describing the potash operations on the alunite deposits of Lake Campion in Western Australia was published in 1949.[9] The raw material is a dark-gray alunitic clay

[8] Horner, C. K., Potash Supply Influenced by Changing World Conditions: Foreign Commerce Weekly, vol. 38, No. 8, Feb. 20, 1950, pp. 3–4, 43–44.
Horner, C. K., Potash—World Production and Supply: U. S. Dept. of Commerce, Office of International Trade, February 1950, 28 pp.
[9] Mining Magazine, Potash from Western Australia: Vol. 80, No. 3, March 1949, pp. 145–147.

occurring in the lake bed. This clay, when washed, contains about 7.25 percent K_2O. The plant is near the town of Chandler, 32 miles north of Merriden (a station on the Perth-Kalgoorlie railway). The lake is 426 acres in extent and contains some 12,000,000 tons of the alunitic clay down to 20 feet, although present excavations average only 7 feet. Borings show that the alunite persists in many places below 20 feet. Reserves are estimated at 1,500,000 tons of recoverable potassium sulfate and 2,000,000 tons of alumina. Rainfall in the lake area averages 10 inches a year; in winter there are 10 inches of water on the lake bed; in summer the water table lies some 30 inches below the surface.

The potash plant uses Diesel-electric power. The clay, excavated by dragline, is roasted, after crushing, in cylindrical roasters, using wood as fuel. The roasted material is leached with acid water, obtained from the Goldfields Water Supply Scheme, a 6-inch branch pipe delivering to the works at Chandler. Leach liquor passes to "mother-liquor" storage tanks, whence it is withdrawn to lines of stainless-steel crystallizing tanks. From these tanks the crystallized potassium sulfate is excavated and kiln-dried before bagging. It is hoped that this operation will make Australia independent of imported supplies.

Another article[10] estimated that the lake alunite would yield 750,000 tons of potash. The private company which set out to work the deposits in 1940 is said to have encountered financial difficulties, and operations have since been financed by the Western Australian Government.

Canada.—Early in 1949[11] it was reported that potash had been discovered at an oil-drilling site near North Battleford, northwestern Saskatchewan.

France.—The potash industry of Alsace has been described in articles published recently.[12] A 10-year development program initiated by the French after World War II called for a gradual expansion in output of the Mines domaniales de potasse d'Alsace up to 1,200,000 tons K_2O in 1957. This project calls for the modernization of underground working methods through the introduction of mechanical loaders, shuttle cars, coal cutters, drilling machines, and other devices. Equipment for treatment by levigation and flotation will supplement the old thermal plants and eventually supersede them. The project was approved by the Economic Cooperation Administration of the United States, which will contribute $4,000,000 in assistance funds.[13]

The Sociéte des mines de potasse et de magnesia du Boudigot, operating in the potash field near Dax in southwestern France, continued exploration with the object of developing a production capacity of 3,000 tons of potash monthly. Work is proceeding on the 400- and 650-meter levels. At 400 meters considerable tonnage has been observed but the content is poor and this zone will be fully exploited only when concentration methods now being studied are completed.

[10] Chemical Age (London), Potash Fertilizer Industry: Vol. 61, No. 1573, Sept. 3, 1949, p. 327.
[11] Oil, Paint and Drug Reporter, Mar. 14, 1949, p. 42.
[12] Rendall, R. E. G., The Potash Basin of Alsace: Mine & Quarry Eng., vol. 15, No. 6, June 1949, pp. 167–173.
Echo des mines et de la métallurgie, La Potasse en France et dans le monde: No. 3412, September 1949, p. 227.
D'Andon, Andre, Douffiagues, J. A., Les mines domaniales de potasse de Alsace, 1918–48: Centre National d'Information Economique, Paris, 1948, 228 pp.
[13] Economic Cooperation Administration press release 752, Aug. 4, 1949, 1 p.

At 650 meters several beds of 1–1.3 meters, containing between 15 and 20 percent K_2O, have been cut.[14]

Israel and Jordan.—Neither the northern nor the southern plant of Palestine Potash, Ltd., operated in 1949. Control of the plant at Sodom at the southern end of the Dead Sea was returned in August 1949 to the company by the occupying Israeli military authorities. This plant is reported intact. The northern plant remains in the hands of Hashemite Jordan.

Poland.—Rich and extensive potash deposits are reported to have been discovered in the Kujawy district (about 100 miles from Warsaw in western Poland). Production is not expected before 1952 or 1953.[15]

Union of South Africa.—Potassium, sodium, and magnesium salts are being recovered from sea water in the plant of the Vrany Chemical Corp., 4 miles north of Saldanha Bay on the west coast of the Union of South Africa. Production was started June 1, 1949. The plant, the first of its kind in South Africa, is said to have a handling capacity of 5,000,000 tons of sea water a day. It is built on a 1,100-morgen site, part of which is laid out in terraced pans, where the sea water is evaporated. The sea water is pumped through pipes laid under the breakers, 300 feet from the shore, and is then distributed through canals to the pans, where a controlled flow maintains a depth of 6 inches. The pans are lined with sun-dried clay to prevent seepage. The residue is scraped from the clay and taken to the purifying plants. Many of the pans are being cemented, and overhead framework is being constructed from which the water will be sprayed to induce more rapid evaporation.[16]

United Kingdom.—Potash was discovered near Whitby, North Yorkshire, England, in 1938–39 by the D'Arcy Exploration Co. in boring for oil. Three salt beds were struck between 3,655 and 4,775 feet. The first salt bed, 15 feet thick carried not more than 1 percent KCl. The second bed, from 3,920 to 4,193 feet, included a thin bed of sylvinite with a maximum KCl content of 34 percent. The third bed, from 4,312 to 4,775 feet, included a 45-foot deposit of polyhalite containing 15.6 percent K_2O.[17]

[14] Chemical Age (London), Expanding French Potash Sources: Vol. 61, No. 1579, Oct. 15, 1949, p. 541.
[15] Foreign Commerce Weekly, vol. 36, No. 10, Sept. 5, 1949, p. 32.
[16] Chemical Age (London), Seawater Magnesium: Vol. 60, No. 1562, June 18, 1949, p. 905.
[17] Report of the Mineral Development Committee (London, England), H. M. S. O., 1949.

Salines—Miscellaneous

By Joseph C. Arundale and F. M. Barsigian [1]

GENERAL SUMMARY

THE mild business recession during the first half of 1949 was reflected in moderate declines in sales of many mineral and chemical materials. Consumers generally were adjusting inventories to a more satisfactory relation with the hesitant market. In some instances, inventory liquidations were reactions to higher prices for raw materials.

In the later months of 1949, the period of readjustment appeared to be over, and there were signs of resumption of all-out industrial activity which promised new records in production, sales, and consumption in the coming year.

Sales of calcium chloride, soda ash, and salt cake decreased. Sales of bromine compounds increased as a result of public demand for more and better gasoline in which ethylene dibromide is used as an ingredient of antiknock compounds.

CALCIUM CHLORIDE

Producers of calcium chloride (and calcium-magnesium chloride) from natural brines reported a smaller tonnage of sales in 1949 than in any postwar year. However, this important industrial material was still being consumed in large quantities for a wide variety of uses. Although no accurate use pattern is available, its hygroscopic and antifreeze properties are widely utilized for such purposes as stabilizing and controlling dust on soil and gravel roads, controlling ice on streets and sidewalks, in refrigerating brines, dustproofing coal, regulating the curing of concrete, as an antifreeze for ore and other material in stockpiles and in railway cars, and as a dehumidifier in storage areas and basements. The United States Department of Agriculture has recently developed a method of farm-drying seeds, using calcium chloride instead of conventional heat methods.[2]

Solvay Sales Division, Allied Chemical & Dye Corp., 40 Rector Street, New York 6, N. Y., published a booklet summarizing the effects of calcium chloride in portland-cement mixes.

The Dow Chemical Co. announced the start of production of calcium chloride in pellet form.

The following companies produced calcium chloride (and calcium magnesium chloride) from natural brines in 1949: California Rock Salt Co., 2436 Hunter Street, Los Angeles 21, Calif., plant at Amboy, Calif.; Hill Bros. Chemical Co., 2159 Bay Street, Los Angeles 21, Calif., plant at Amboy, Calif.; Desert Properties Co., Frank Thomas, receiver, 374 Court Street, San Bernardino, Calif., plant at Amboy, Calif.; Michigan Chemical Corp., 500 North Bankson, St. Louis,

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[2] Chemical Industries, Calcium Chloride Dries Seed: Vol. 65, No. 2, August 1949, p. 250.

Mich.; Rademaker Chemical Corp., Eastlake, Mich.; Dow Chemical Co., Midland, Mich.; Pomeroy Salt Corp., Pomeroy, Ohio, plant at Minersville, Ohio; Westvaco Chemical Division, Food Machinery & Chemical Corp., South Charleston 3, W. Va.; and Liverpool Salt Co., Hartford, W. Va.

Calcium chloride and calcium-magnesium chloride from natural brines sold by producers in the United States, 1945–49

[In terms of 75 percent (Ca, Mg) Cl_2]

Year	Short tons	Value	Year	Short tons	Value
1945	218,320	$1,818,219	1948 [1]	309,660	$3,906,858
1946	262,147	2,278,954	1949	255,797	3,260,675
1947	271,206	2,650,205			

[1] Revised figures.

Calcium chloride imported for consumption in and exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Imports		Exports	
	Short tons	Value	Short tons	Value
1945	4,040	$51,409	6,871	$188,141
1946	1,313	14,587	10,073	367,993
1947	250	5,514	11,955	502,818
1948	5	249	11,456	437,763
1949	(1)	20	21,094	507,845

[1] Less than 1 ton.

According to Oil, Paint and Drug Reporter the following prices on calcium chloride were quoted during 1949: Flake, 77–80 percent, paper bags, carlots, works, freight equaled, ton, $22; liquor, works basis 40 percent, tank cars, ton, $9; solid, 73–75 percent, drums, carlots, works, same basis, $20. Calcium chloride pellets, bags, carlots, works, were quoted at $29 per ton at the end of 1949.

BROMINE

Sales of bromine compounds increased substantially in 1949, the bulk of the increase being attributable to the quantity use of ethylene dibromide. With the Nation's automobile drivers demanding more and better gasoline, the peacetime use of this compound as an ingredient of antiknock compounds is reaching unprecedented levels.

A new plant for the extraction of bromine and other chemicals from sea water started production at Jacob's Bay, 4 miles north of Saldanha Bay, South Africa. This new plant is expected to produce 200 tons of bromine annually.[3]

The Ethyl-Dow Chemical Co. recovered bromine from sea water at Freeport, Tex., and continued to be the largest producer. The Dow Chemical Co., Midland, Mich., second largest producer, recovered bromine from Michigan well brines. American Potash &

[3] Chemical Age (London), vol. 60, No. 1562, June 18, 1949, p. 905.

Chemical Corp., 3030 West Sixth Street, Los Angeles 54, Calif., recovered bromine from Searles Lake, and Westvaco Chemical Division, Food Machinery & Chemical Corp., 405 Lexington Avenue, New York 17, N. Y., from its sea-water bitterns plant at Newark, Calif. The following won bromine from well brines: Great Lakes Chemical Corp., 502 Michigan National Bank Bldg., Grand Rapids 2, Mich., plant at Filer City, Mich.; Michigan Chemical Corp., 500 North Bankson, St. Louis, Mich.; Morton Salt Co., 120 South La Salle Street, Chicago 4, Ill., plant at Manistee, Mich.; Rademaker Chemical Corp., Eastlake, Mich.; and Westvaco Chemical Division, Food Machinery & Chemical Corp., South Charleston 3, W. Va.

According to Oil, Paint and Drug Reporter, potassium and sodium bromides, U. S. P., barrels or kegs, were quoted at 33–34 cents a pound during 1949. This represented no change from the previous year. Imports of bromine and bromine compounds totaled 87 pounds, whereas 925,639 pounds valued at $402,899 were exported.

Bromine and bromine in compounds sold or used by producers in the United States, 1945–49

Year	Pounds	Value	Year	Pounds	Value
1945	79,709,857	$14,796,229	1948	76,047,551	[1] $14,825,470
1946	42,780,925	8,560,434	1949	88,725,709	16,267,908
1947	78,177,650	14,837,104			

[1] Revised figure.

Bromine and bromine compounds sold by primary producers in the United States, 1948–49

	1948			1949		
	Pounds		Value	Pounds		Value
	Gross weight	Bromine content [1]		Gross weight	Bromine content [1]	
Elemental bromine	3,300,496	3,300,496	$478,849	3,428,476	3,428,476	$539,355
Sodium bromide	746,121	579,363	194,924	808,922	628,128	209,041
Potassium bromide	2,129,764	1,430,136	547,362	1,925,997	1,293,307	498,603
Ammonium bromide	370,975	302,641	105,906	264,862	216,075	77,509
Other including ethylene dibromide	83,791,199	70,434,915	[2] 13,498,429	98,407,345	83,159,723	14,943,400
Total	90,338,555	76,047,551	[2] 14,825,470	104,835,602	88,725,709	16,267,908

[1] Calculated as theoretical bromine content present in compound.
[2] Revised figure.

IODINE

Dow Chemical Co., Midland, Mich., and Deepwater Chemical Co., Ltd., Compton, Calif, recovered iodine from waste oilfield brines in California. As there were only two domestic producers during 1949, the Bureau of Mines may not publish the statistics on production of iodine. However, domestic production in 1937 (the latest year for which figures were published) was nearly 300,000 pounds, and production in recent years has exceeded that figure.

A large part of the iodine consumed in the United States is used

as potassium iodide in photographic emulsions and animal feeds, but other important uses are in pharmaceutical preparations, iodized salts, dyes, and in organic synthesis. The results of a Bureau of Mines canvass of iodine consumption are shown in an accompanying table. A similar table shown in Minerals Yearbook, 1948, is not strictly comparable because it did not include all iodine consumed in making organic compounds.

Crude iodine consumed in the United States in 1949

Compound manufactured	Number of plants	Crude iodine consumed	
		Pounds	Percent of total
Resublimed iodine	5	117,965	11
Potassium iodide	9	753,911	69
Sodium iodide	5	42,453	4
Other inorganic compounds	7	34,676	3
Organic compounds	12	145,553	13
Total	[1] 22	1,094,558	100

[1] A plant producing more than 1 product is counted but once in arriving at total.

The history of the domestic iodine industry was summarized, and the process of recovering iodine from oil-well brines was described.[4]

A new periodical known as Iodine Abstracts and Reviews was prepared by the Iodine Fellowship at Mellon Institute and published by the Chilean Iodine Educational Bureau, Inc., 120 Broadway, New York 5, N. Y. This publication provides summaries of scientific and technical literature relating to the uses of iodine and its compounds in chemistry and in the industries.

According to the Oil, Paint and Drug Reporter, the price of crude iodine, kegs, ex-warehouse, Staten Island, was $1.729 a pound in January to August 1949. At the same time resublimed was quoted at $2.55–$2.65 per pound in bottles or jars. In September and for the remainder of the year, crude iodine in kegs was quoted at $1.52–$1.729, and resublimed, U. S. P., in bottles or jars at $2.30–$2.48.

Imports of crude iodine decreased in 1949; however, imports of iodine are characteristically erratic and generally bear little relation to current consumption rates. Large stocks are usually maintained in consuming countries, principally the United States, by Chilean Nitrate Sales Corp., sales agent for producers in Chile. Chile was the principal foreign source of iodine, but Japan is supplying increasing quantities recovered from seaweed.

Crude iodine imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Pounds	Value	Year	Pounds	Value
1945	220,526	$232,070	1948	592,136	$847,752
1946	886,578	976,190	1949	489,999	719,758
1947	2,260,506	2,756,888			

[4] Industrial and Engineering Chemistry, vol. 41, No. 8, August 1949, pp. 1547–1552.

SODIUM COMPOUNDS

Sodium Carbonate.—After several years of serious world-wide shortages of alkalies, the situation was reversed, and in 1949 a condition of general oversupply was a problem in the case of soda ash. Domestic producers of natural sodium carbonate reported a sharp drop in sales, and there were numerous reports of shut-downs or curtailments at plants throughout the world. Value of domestic sales of natural soda ash was off more than a third. Stocks were adequate for prompt shipments throughout the year. Consumption of this major alkali in such products as glass, caustic soda, bicarbonate, and other chemicals dropped. Exports were only a fraction of the previous year, due to the world dollar shortage, the effects of devaluation, and increased availability from foreign sources.

Natural soda ash was produced in California by the following companies in 1949: American Potash & Chemical Corp., 3030 West Sixth Street, Los Angeles 54, Calif., on Searles Lake; Natural Soda Products Co., 506 Central Tower Building, San Francisco 3, Calif., plant at Keeler; Pittsburgh Plate Glass Co., Columbia Chemical Div., Bartlett, Calif.; and West End Chemical Co., 608 Latham Square Bldg., Oakland 12, Calif., plant at Westend.

Manufactured sodium carbonate produced [1] and natural sodium carbonates sold or used by producers in the United States, 1945–49

Year	Manufactured soda ash (ammonia-soda process) [2]	Natural sodium carbonates [3]	
	Short tons	Short tons	Value
1945	4,375,017	194,045	$3,034,118
1946	4,284,231	215,625	3,427,086
1947	[4] 4,524,668	293,051	5,862,178
1948	4,575,452	[5] 288,769	[5] 6,623,280
1949	3,916,016	[5] 200,496	[5] 4,163,714

[1] U. S. Bureau of the Census.
[2] Total wet and dry (98–100 percent Na_2CO_3). Includes quantities used in manufacturing caustic soda and sodium bicarbonate and quantities processed to finished light and finished dense soda ash.
[3] Soda ash and trona.
[4] Revised figure.
[5] Exclusive of Wyoming.

On January 1, 1949, soda ash was removed from export-license requirements except for certain destinations. A summary of this alkali export-control program was published.[5]

Certain export practices of the United States Alkali Export Association and the California Alkali Export Association and their members were held in violation of the antitrust laws.[6]

Announcement was made that a large soda-ash plant was to be erected on the Vaal River near Douglas, Northern Cape Province, South Africa. Source of the brine to be used is a 500-acre salt lake, 22 miles away, from which the brine will be pumped. The projected output of soda ash is 300 short tons daily.[7]

[5] Koster, W. R., An Appraisal of Alkali Export Control: Chem. and Eng. News, vol. 27, No. 19, May 9, 1949, pp. 1354–1357.
[6] Oil, Paint and Drug Reporter, vol. 156, No. 8, Aug. 22, 1949, pp. 4, 46–47.
[7] American Consulate General, Capetown, South Africa, Rept. 32, June 7, 1949.

The price of soda ash, light, 58 percent, bags, carlots, works, was quoted at $1.40 a 100 pounds in 1949, according to Oil, Paint and Drug Reporter.

The consumption pattern of sodium carbonate, as estimated by Chemical Engineering, is shown in the accompanying table.

Estimated consumption of sodium carbonate in the United States, 1945–49, by industries, in short tons

[Chemical Engineering]

Industry	1945	1946	1947	1948	1949
Glass	1,320,000	1,400,000	1,440,000	1,370,000	1,190,000
Soap	150,000	120,000	135,000	[1] 130,000	125,000
Caustic and bicarbonate	1,114,000	1,128,000	[1] 1,130,000	1,137,000	850,000
Other chemicals	960,000	910,000	1,030,000	1,030,000	950,000
Cleansers and modified sodas	110,000	125,000	130,000	135,000	130,000
Pulp and paper	175,000	190,000	[1] 260,000	230,000	200,000
Water softeners	100,000	90,000	100,000	110,000	110,000
Petroleum refining	24,000	20,000	22,000	24,000	24,000
Textiles	68,000	77,000	71,000	69,000	55,000
Nonferrous metallurgy	200,000	140,000	190,000	210,000	210,000
Exports	70,000	67,000	107,000	[1] 207,000	77,000
Miscellaneous	290,000	223,000	[1] 185,000	[1] 220,000	179,000
Total	4,581,000	4,490,000	4,800,000	[1] 4,872,000	4,100,000

[1] Revised figure.

Sodium Sulfate.—Sales of natural sodium sulfates by producers in 1949 dropped sharply, as did production of salt cake (including natural sodium sulfates). Conforming to the general trend of industrial activity, the consumption of salt cake in such industries as kraft paper, glass, stock feeds, metallurgy, and detergents all declined.

The following firms reported production of natural sodium sulfates in 1949: American Potash & Chemical Corp., 3030 West Sixth Street, Los Angeles 54, Calif., on Searles Lake; Arizona Chemical Co., 30 Rockefeller Plaza, New York 20, N. Y., plant at Brownfield, Tex. (sold to Heat & Power Co., 70 Pine Street, New York, N. Y., January 27, 1950); Dale Chemical Industries, Inc., P. O. Box 319, Twenty Nine Palms, Calif.; Iowa Soda Products Co., P. O. Box 476, Council Bluffs, Iowa, plant at Rawlins, Wyo.; Ozark-Mahoning Co., P. O. Box 449, Tulsa 1, Okla., plant at Monahans, Tex.; and William E. Pratt, P. O. Box 738, Casper, Wyo.

The sodium sulfate deposit and producing facilities of Saskatchewan Minerals, at Lake Chaplin, Province of Saskatchewan, Canada, were described.[8]

According to the Oil, Paint and Drug Reporter, at the first of the year domestic salt cake was quoted at $25–$28 a short ton, bulk, works. Later in the year, this material was quoted on a delivered basis at $24–$26 a short ton. Anhydrous sodium sulfate was unchanged at $2.10 per 100 pounds, works; Glauber's salt was unchanged at $2.25–$2.50 per 100 pounds, less than carlots, bags, works.

[8] Holland, A. A., The Chaplin Sodium Sulphate Plant, Sask.: Canadian Min. and Met. Bull., vol. 42, No. 446, June 1949, pp. 276–279.

Sodium sulfate produced and sold or used by producers in the United States, 1945–49

Year	Production (manufactured [1] and natural), short tons			Sold or used by producers (natural only)	
	Salt cake (crude)	Glauber's salt (100 percent $Na_2SO_4.10H_2O$)	Anhydrous refined (100 percent Na_2SO_4)	Short tons [2]	Value
1945	543,371	200,782	91,340	178,196	$1,525,159
1946	527,746	167,153	122,573	198,781	1,695,413
1947	[3] 693,517	[3] 202,285	[3] 134,969	257,294	3,329,094
1948	[3] 668,246	[3] 184,744	169,018	265,862	4,248,613
1949	537,843	156,634	136,276	186,223	2,733,853

[1] U. S. Bureau of the Census.
[2] Includes Glauber's salt converted to 100 percent Na_2SO_4 basis.
[3] Revised figure.

Sodium sulfate imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Crude (salt cake)		Crystallized (Glauber's salt)		Anhydrous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	20,293	$289,940					20,293	$289,940
1946	22,446	352,407					22,446	352,407
1947	49,157	583,377	91	$1,760			49,248	585,137
1948	29,612	468,561					29,612	468,561
1949	21,090	294,367	53	1,152	245	$4,953	21,388	300,472

Sodium Metal.—E. I. du Pont de Nemours & Co., Inc., Niagara Falls, N. Y., and Ethyl Corp., Baton Rouge, La., produce metallic sodium, estimated annual output capacities of the two plants being 75 and 64 million pounds, respectively.[9] During 1949, Ethyl Corp. expanded its plant capacity by an estimated additional 36 million pounds. In Ashtabula, Ohio, National Distillers Chemical Corp. was constructing a new $10,000,000 facility, also with an estimated 36-million-pound annual capacity.[10] Production at the latter plant was expected to start early in 1950. During World War II, Dow Chemical Co. produced sodium at Midland, Mich.

Sodium metal is most extensively used as a chemical raw material, principally for the production of tetraethyl lead, lesser quantities being required in making sodium cyanide, synthetic detergents (sodium alkyl sulfate), etc. The approximate end-use pattern for sodium

[9] Zabel, Herman W., Metallic Sodium, Its Production and Use: Chem. Ind., vol. 65, No. 5, November 1949, pp. 714–716.
[10] Chemical and Engineering News, vol. 27, No. 22, May 30, 1949, p. 1602.
National Distillers Chemical Corp., Sodium: July 1949, 50 pp.

metal in 1947 and 1948 is shown in the following table; figures shown indicate millions of pounds.[11]

Use:	1947	
Tetraethyl lead	66	90
Sodium cyanide	25	32
Sodium alkyl sulfate	25	
Sodium peroxide	7	7
Sodium hydride	2	2
Indigo synthesis	2	2
Miscellaneous	6	6

Miscellaneous uses for sodium include its employment as metal in sodium-cooled engine valves and in special heat exchangers. Sodium is also used in producing potassium metal. Both sodium metal and sodium-potassium alloys have been seriously considered by the Atomic Energy Commission for use in proposed nuclear reactor heat exchangers.

Prices for sodium metal in 1949 were 16½ cents per pound in drums, carlots; 17 cents per pound, less than carlots.

BORATES

After slumping in 1948, sales of boron minerals increased in 1949, and total sales for the year approached the record high of 1947. Imports declined, but exports set a new all-time high. Although domestic consumption of boron minerals was the lowest in the postwar period, a large tonnage of exports more than offset this decline.

The technical literature included articles on the nature of the action of boron in hardening of various steel alloys,[12] the effects of borax in porcelain enamels,[13] a new high-temperature titanium-boron steel,[14] the thermodynamics of boron carbide,[15] and the properties of chromium boride and sintered chromium boride.[16]

Salient statistics of the boron-mineral industry in the United States, 1945–49

	1945	1946	1947	1948	1949
Sold or used by producers: [1]					
Short tons:					
Gross weight	325,935	430,689	501,935	450,932	467,592
B_2O_3 content	104,600	129,800	145,700	134,700	139,200
Value [2]	$7,635,365	$9,575,866	$11,844,108	$11,147,735	$11,511,893
Imports for consumption (refined):					
Pounds	1,344	100,567	[3] 1,884	3,056	886
Value	$491	$4,077	$747	$1,503	$435
Exports:					
Short tons	43,475	53,303	85,736	70,940	109,491
Value	$2,059,510	$2,644,760	$4,651,642	$4,075,049	$6,862,928
Apparent consumption: [4]					
Short tons	282,461	377,436	416,200	379,994	358,101

[1] Borax, anhydrous sodium tetraborate, kernite, boric acid, and colemanite.
[2] Partly estimated.
[3] Revised figure.
[4] Quantity sold or used by producers plus imports minus exports.

[11] Work cited in footnote 9.
[12] Chemical Age, vol. 61, No. 1569, Aug. 6, 1949, Metallurgical Section, pp. 195–196.
[13] Ceramic Industry, vol. 52, No. 5, May 1949, p. 59.
[14] Steel, vol. 124, No. 26, June 27, 1949, pp. 58–61, 92 and 94.
[15] King, E. G., High-Temperature Heat Content of Boron Carbide: Ind. Eng. Chem., vol. 41, No. 6, June 1949, pp. 1298–1299.
[16] Sindeband, S. J., Properties of Chromium Boride and Sintered Chromium Boride: Jour. Metals, vol. 1, No. 2, February 1949, pp. 198–202.

In 1949 the following firms reported production of boron minerals: American Potash & Chemical Corp., 3030 West Sixth Street, Los Angeles 54, Calif., plant at Trona, on Searles Lake; Pacific Coast Borax Co., 510 West Sixth Street, Los Angeles 14, Calif., mine at Boron; Pittsburgh Plate Glass Co., Columbia Chemical Division, Bartlett, Calif.; United States Borax Co., 510 West Sixth Street, Los Angeles 14, Calif., mine near Shoshone; and West End Chemical Co., 608 Latham Square Bldg., Oakland 12, Calif., plant at Westend, on Searles Lake.

New prices in effect January 1, 1949, on borax and boric acid eliminated the 1-percent cash discount and were on a straight f. o. b. basis instead of the former freight split arrangement. This resulted in net increases to eastern buyers. According to Oil, Paint and Drug Reporter, the price of technical borax, 99½ percent, granular, bulk, carlots, works, was $31.25 a short ton.

Salt

By Florence E. Harris and E. M. Tucker

GENERAL SUMMARY

TOTAL salt production in 1949 receded more than 800,000 short tons from the 1948 production—a decrease of 5 percent. Most of the recession occurred in rock salt, the output being 10 percent less than in the preceding year. Total salt content in brine declined 5 percent. Evaporated-salt output, however, increased 2 percent.

Thirteen States and Puerto Rico produced 15,590,697 short tons valued at $54,048,226. Imports increased slightly; apparent consumption and exports decreased.

Salient statistics of the salt industry in the United States, 1935–39 (average), and 1945–49

	1935–39 (average)	1945	1946	1947	1948	1949
Sold or used by producers:						
Dry salt:						
Evaporated (manufactured) short tons	2,507,374	3,182,570	3,249,457	3,158,718	3,207,403	3,284,361
Rock salt ... do	1,947,254	3,505,740	3,412,008	3,754,353	3,846,846	3,468,005
Total ... do	4,454,628	6,688,310	6,661,465	6,913,071	7,054,249	6,752,366
Value	$21,730,339	$37,335,488	$38,294,396	$43,032,621	$46,430,927	$46,353,711
Average per ton	$4.88	$5.58	$5.75	$6.22	$6.58	$6.86
In brine:						
Short tons	4,205,587	8,705,831	8,470,680	9,140,811	9,349,044	8,838,331
Value	$1,675,273	$6,578,918	$6,618,190	$9,159,067	$7,900,855	$7,694,515
Total salt:						
Short tons	8,660,215	15,394,141	15,132,145	16,053,882	16,403,293	15,590,697
Value [1]	$23,405,612	$43,914,406	$44,912,586	$52,191,688	$54,331,782	$54,048,226
Imports for consumption:						
Short tons	46,766	4,553	4,253	1,910	5,621	6,309
Value	$111,411	$73,390	$29,628	$22,893	$40,748	$50,605
Exports:						
Short tons	90,214	190,524	223,426	[2] 188,307	[3] 387,601	359,776
Value	$521,652	$1,509,801	$1,889,522	[2] $1,588,847	[3] $5,980,170	$3,358,115
Apparent consumption [4] short tons	8,616,767	15,208,170	14,912,972	[3] 15,771,006	[3] 16,021,313	15,237,230

[1] Values are f. o. b. mine or refinery and do not include cost of cooperage or containers.
[2] 96,479 short tons valued at $2,347,679, shipped under the U. S. Army Civilian Supply Program, is excluded from exports shown but is deducted from apparent consumption.
[3] Revised figure.
[4] Quantity sold or used by producers plus imports minus exports.

In 1949, 46 companies produced salt in 71 plants compared with 43 companies and 71 plants in 1948.

Figure 1 shows that both the industrial production and salt-production index lines dropped. Industrial production was 16 points lower in 1949 than in 1948. However, the 1949 dry-salt index was only 6 points lower. The brine index, although 12 points lower than in 1948, was still 34 points above the industrial production line. In 1948 the brine index was 30 points above the industrial production.

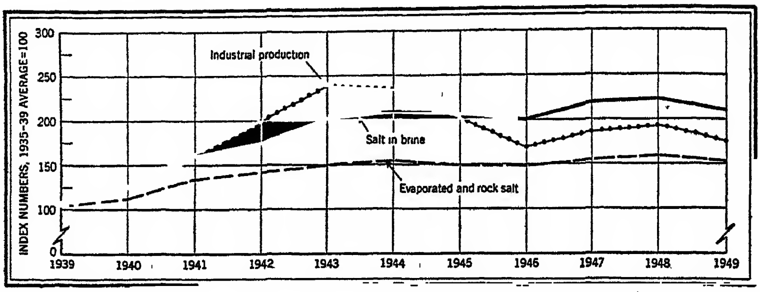

FIGURE 1.—Index of salt in brine and of evaporated and rock salt sold or used compared with industrial production, 1939–49. Index of industrial production from Federal Reserve Board.

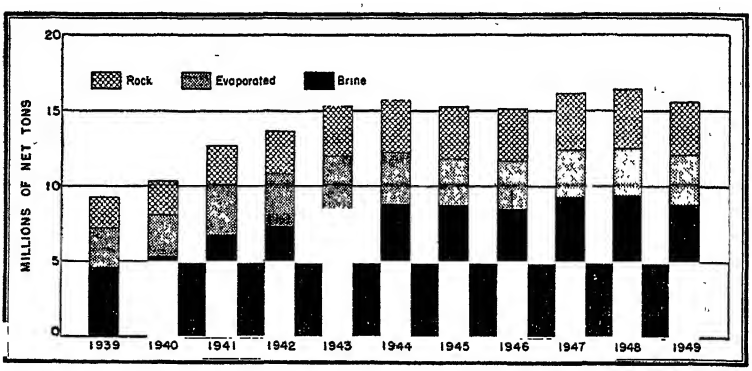

FIGURE 2.—Trends in the quantity of rock salt, evaporated salt, and brine (in terms of salt content) sold or used by producers in the United States, 1939–49.

Trends in the past 15 years are shown in the accompanying table as 5-year averages.

Salt sold or used by producers in the United States, 1935–49 (5-year averages), in short tons

Type	1935–39 (average)	1940–44 (average)	1945–49 (average)
Evaporated salt	2,507,374	3,311,152	3,216,502
Rock salt	1,947,254	2,878,860	3,597,390
Salt in brine	4,205,587	7,351,028	8,900,939
Total	8,660,215	13,541,040	15,714,831

A review of the economics of the salt industry, including descriptions of the world's principal deposits, was published.[1] The Bureau of Mines prepared a guide to cost estimates of chemical processes, which may have some application to salt making.[2]

[1] Phalen, W. C., Salt: Industrial Minerals and Rocks, Am. Inst. Min. and Met. Eng., New York, 2d ed., 1949, pp. 807–843.

[2] Van Noy, C. W., Dunville, T. C., Dreisler, R. G., and Chaffee, C. C., Guide for Making Cost Estimates of Chemical-Type Operations; Bureau of Mines Rept. of Investigations 4534, 1949, 64 pp.

A report[3] on the Retsof mine, in New York, was issued in 1949. A recent book,[4] popularly written, covers a good deal of the history of the salt industry, especially the Morton Salt Co.

Corrosion has always been a serious problem in the production and use of salt occurring in the production equipment and in salt storage places. It must be overcome not only because of the damage it causes to expensive metal equipment and machinery but also for maintenance of the purity of salt for chemical processes and for food preservation.[5] It was reported[6] that many new developments in corrosion-resistant coatings, plating, and metallurgy were discussed in papers presented before the ninety-fifth convention of the Electrochemical Society in Philadelphia in 1949.

PRODUCTION

PRODUCTION BY STATES

California.—The Reeder Salt Co. produced rock salt at Rice, San Bernardino County, Calif., in 1949. The Dale Chemical Co., Twentynine Palms, had no output of salt during the year. Production of salt by the Long Beach Salt Co. at Dry Lake, Kern County, depends upon rain. As there was no rainfall in the vicinity in 1949, there was no output. A report[7] describes the works, which consist of six vats covering 69 acres. Water pumped into a ditch, 20 feet wide by 3 feet deep, empties into vats one-half mile from the pump. The company has discontinued refining table salt. The product is used for stock salt, hides, fish bait, chicken feed, and hay.

Salt sold or used by producers in the United States, 1947–49, by States

State	1947			1948			1949		
	Quantity		Value	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total		Short tons	Percent of total	
California	768,397	5	$3,810,898	914,035	6	$3,927,722	964,807	6	$4,110,271
Kansas	904,398	6	4,534,406	831,756	5	4,960,828	854,707	5	5,373,489
Louisiana	1,955,382	12	5,898,828	2,223,249	13	6,444,751	2,030,076	13	5,837,714
Michigan	4,447,269	28	15,043,057	4,387,879	27	16,265,743	4,064,106	26	16,009,117
New Mexico	12,006	(1)	19,239	(2)	(2)	(2)	(2)	(2)	(2)
New York	2,923,023	18	11,875,485	3,065,831	19	13,056,542	2,951,750	19	13,042,322
Ohio	2,975,676	18	6,815,639	2,752,696	17	5,884,343	2,195,778	14	5,134,923
Puerto Rico	13,344	(1)	101,287	15,145	(1)	112,072	12,664	(1)	77,322
Texas	1,191,621	7	2,090,098	1,354,109	8	1,712,169	1,637,388	11	2,453,803
Utah	113,285	1	340,028	113,779	1	429,494	78,611	1	386,935
West Virginia	279,300	2	1,161,429	246,732	1	1,197,645	355,515	2	1,288,471
Other States[3]	470,181	3	501,294	498,082	3	340,473	445,295	3	333,859
Total	16,053,882	100	52,191,688	16,403,293	100	54,331,782	15,590,697	100	54,048,226

1 Less than 0.5 percent.
2 Included with "Other States."
3 Includes Nevada, New Mexico (1948 and 1949), Oklahoma, and Virginia.

3 Eathorne, William, Operations and Safety at the Retsof Rock Salt Mine: Bureau of Mines Inf. Circ. 7522, 1949, 12 pp.
4 Eskew, Garnett Laidlaw, Salt—the Fifth Element: J. G. Ferguson & Associates, Chicago, Ill., 1948, 239 pp.
5 International Nickel Company of Canada, Ltd., Salt as a Corrosion Problem: Toronto, Canada, 21 pp.
6 Steel, vol. 125, No. 2, July 11, 1949, p. 83.
7 California Journal of Mines and Geology, vol. 45, No. 2, April 1949, p. 250.

Kansas.—Morton Salt Co. reports that its mine at Kanopolis, Kans., was abandoned permanently on June 30, 1949.

New Mexico.—It was announced [8] that salt lake areas at Willard, Torrance County, N. Mex., had been leased and would be worked soon for salt as an ingredient for a new type of fertilizer. It is planned that shallow wells will be drilled in the lake bottoms for the extraction of brine ("liquid salt"). The product, it was stated, is to be a "soil activator" for citrus orchards. The plant will have 20 employees at the start.

Texas.—The Frontier Chemical Co., Denver City, Tex., produced brine for chemicals in 1949. The assets of the Imperial Salt Co., Henderson, were taken over by the Gulf Salt Co., organized in 1949, at Houston. The Morton Salt Co. plant at Grand Saline, damaged by fire in the fall of 1948, was moved to the company salt mine outside Grand Saline. The usable refinery and other equipment were rebuilt and production was resumed. The Texas Brine Corp., operating at Hockley, produced brine in 1949.

Utah.—Jesse Coulson, Nephi, Utah, has closed and produced no salt in 1949.

West Virginia.—J. Q. Dickenson & Co., Malden, W. Va., reports that the plant was temporarily closed in 1949 and no salt produced. However, some purchased salt was resold.

Puerto Rico.—Salt production declined in Puerto Rico because of excessive rainfall, which not only prevented new production but leached salt in stock. A 2-month strike at one operation during the chief producing period also interfered with output. Prices remained the same as in 1948. Puerto Rican salt is used for household purposes, cement manufacture, and curing hides.

PRODUCTION BY METHODS OF RECOVERY

Basic methods of salt recovery were described briefly in the Salt chapter of Minerals Yearbook, 1948. The accompanying table shows the quantities produced by the various methods.

Salt sold or used by producers in the United States, 1948–49, by method of recovery

Method of recovery	1948		1949	
	Short tons	Value	Short tons	Value
Evaporated:				
Bulk:				
Open pans or grainers	462,325	$6,868,010	504,771	$6,956,724
Vacuum pans	1,724,264	16,908,921	1,744,569	16,950,986
Solar	746,303	2,749,560	766,183	2,818,374
Pressed blocks	274,511	2,933,694	268,838	3,230,985
Rock:				
Bulk	3,798,016	16,510,756	3,404,791	15,798,750
Pressed blocks	48,830	459,986	63,214	597,892
Salt in brine (sold or used as such)	9,349,044	7,900,855	8,838,331	7,694,515
Total	16,403,293	54,331,782	15,590,697	54,048,226

[8] Engineering and Mining Journal, vol. 150, No. 10, October 1949, p. 130.

Evaporated Salt.—Produced either from the original brine of wells and ponds or from artificial brine made by forcing water into beds of rock salt, the evaporated-salt output was contributed by 45 plants in 12 States and Puerto Rico. In 1949 the tonnage increased by 76,958 short tons over that of 1948.

Evaporated salt sold or used by producers in the United States, 1948–49, by States

State	1948		1949	
	Short tons	Value	Short tons	Value
California	740,418	$3,464,327	844,227	$3,793,838
Kansas	321,812	3,255,070	334,611	3,617,166
Louisiana	88,304	991,871	99,725	886,953
Michigan	871,226	9,705,533	873,949	9,804,170
New York	429,870	5,620,727	417,518	5,867,504
Ohio	441,169	4,287,147	445,591	3,976,109
Puerto Rico	15,145	112,072	12,664	77,322
West Virginia	120,397	1,072,758	136,666	1,104,542
Other States [1]	179,062	950,680	119,410	829,465
Total	3,207,403	29,460,185	3,284,361	29,957,069

[1] Includes Nevada, New Mexico, Oklahoma, Texas, and Utah.

Rock Salt.—As in 1948, rock salt was produced in eight States although from 20 mines compared with 19 mines in 1948. Production declined 378,841 short tons in 1949 from the record high of 1948. Rock salt entered the 3-million-ton bracket in 1943, has continued therein ever since, and consistently has represented more than 50 percent of the annual output of dry salt.

Rock salt sold by producers in the United States, 1945–49

Year	Short tons	Value	Year	Short tons	Value
1945	3,505,740	$12,964,391	1948	3,846,846	$16,970,742
1946	3,412,008	13,308,001	1949	3,468,005	16,396,642
1947	3,754,353	15,989,680			

Pressed Blocks.—In 1949 pressed blocks were made of evaporated salt by 23 plants and from rock salt by 9 plants. As shown in the following table, primary salt producers make many more blocks from evaporated salt than rock salt. The total output of blocks increased 8,711 tons in 1949 over 1948.

Pressed-salt blocks sold by original producers of the salt in the United States, 1945–49

Year	From evaporated salt		From rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	242,632	$2,479,109	94,811	$849,154	337,443	$3,328,263
1946	298,314	2,942,966	97,060	828,412	395,374	3,771,378
1947	260,399	2,708,857	69,163	638,958	329,562	3,347,815
1948	274,511	2,933,694	48,830	459,986	323,341	3,393,680
1949	268,838	3,230,985	63,214	597,892	332,052	3,828,877

Salt Content of Brine.—Seventeen operations produced brine in seven States. Although output declined 5 percent from that of 1948, salt of brine constituted 57 percent of total production of salt, as in 1948.

CONSUMPTION AND USES

The quantity of salt consumed in the United States declined in 1949. Except for chlorine making, water treatment, meat packing, other food processing, agriculture, and metallurgy, all other items showed decreases.

The largest consumption decrease was in salt of brine used for making soda ash, which totaled more than 1,000,000 short tons. Soda-ash operations especially were affected by the coal strike and the consequent long enforced idleness of steel works and dependent industries, all of which lowered the demand for salt for this chemical. Because of the generally mild winter, less rock salt was required for ice control on city streets, railroad switches, and similar purposes; this was reflected in the decline in rock-salt output.

Salt sold or used by producers in the United States, 1948–49, by classes and uses, in short tons

Use	1948				1949			
	Evaporated	Rock	Brine	Total	Evaporated	Rock	Brine	Total
Chlorine, bleaches, chlorates, etc.	336,180	705,315	1,796,533	2,838,028	366,972	681,408	2,386,057	3,434,437
Soda ash	(1)		7,392,248	7,392,248	(1)		6,255,242	6,255,242
Dyes and organic chemicals	78,873	104,401		183,274	50,657	58,049		108,706
Soap (precipitant)	33,350	10,852		44,202	26,561	10,715		37,276
Other chemicals	91,529	523,737	(2)	615,266	85,691	442,282	(2)	527,973
Textile processing	22,838	92,555		115,393	25,625	83,749		109,374
Hides and leather	79,964	150,647		230,611	76,378	137,962		214,340
Meat packing	324,041	366,259		690,300	329,834	379,281		709,115
Fish curing	15,351	19,997		35,348	12,405	13,199		25,604
Butter, cheese, and other dairy products	97,339	5,017		102,356	64,685	5,305		69,990
Canning and preserving	125,958	18,853		144,811	109,584	14,587		124,171
Other food processing	193,896	19,279		213,175	195,403	20,236		215,639
Refrigeration	20,540	196,087		216,627	19,598	146,871		166,469
Livestock	553,966	238,532		792,498	551,954	220,587		772,541
Highways, railroads, dust and ice control	8,260	460,674		468,934	7,804	404,634		412,438
Table and other household	499,339	173,648		672,987	496,739	131,041		627,780
Water treatment	193,861	253,095	(2)	446,956	229,114	262,264	(2)	491,378
Agriculture	13,609	19,867		33,476	20,317	29,030		49,347
Metallurgy	16,625	49,152		65,777	19,051	53,934		72,985
Undistributed [3]	501,884	438,879	160,263	1,101,026	595,989	372,871	197,032	1,165,892
Total	3,207,403	3,846,846	9,349,044	16,403,293	3,284,361	3,468,005	8,838,331	15,590,697

[1] Data for evaporated salt included with "Undistributed."
[2] Data for salt in brine included with "Undistributed."
[3] Comprises miscellaneous uses and data not presentable by classes (footnotes 1 and 2), including most exports.

The increase of more than one-half million tons of salt for chlorine making partly offset the decrease in the use for soda ash. The prolonged hot weather in 1949 increased requirements for chlorine for sanitation purposes and salt for water treatment. Moreover, there was great demand for chloral for making large quantities of DDT for exportation as well as for domestic use. Nevertheless, the over-all decline in salt content of brine was 5 percent. The increase in salt

used for meat packing is attributed to the large slaughter of hogs in 1949, as requirements are much greater for pork packing and curing than for other meat products.

Miscellaneous uses of salt not listed separately in the accompanying table include sales to State and Federal Governments and to industry for brick and tile, pulp and paper, synthetic rubber, oil-well drilling, laundering and cleaning, coal, and tobacco.

Primary shipments of salt to the various States are shown in the accompanying table. This is the only available measure of consumption by States.

Distribution (shipments) of evaporated and rock salt in the United States, 1948–49, by States of destination, in short tons

Destination	1948		1949	
	Evaporated	Rock	Evaporated	Rock
Alabama	14,875	93,655	15,647	94,788
Arizona	15,732	3,014	18,760	2,498
Arkansas	11,278	41,607	11,170	41,096
California	355,451	65,116	369,225	63,227
Colorado	37,276	36,821	33,812	24,791
Connecticut	13,432	23,409	13,429	14,903
Delaware	8,005	12,206	5,875	12,551
District of Columbia	5,843	2,654	5,368	2,059
Florida	10,342	31,569	10,804	28,560
Georgia	22,464	42,556	24,652	41,054
Idaho	19,978	1,394	16,543	1,426
Illinois	227,036	223,613	231,529	247,275
Indiana	103,022	76,510	105,186	62,068
Iowa	101,813	103,541	108,181	107,251
Kansas	49,151	137,744	52,743	180,186
Kentucky	33,803	66,252	32,673	58,083
Louisiana	14,690	135,167	13,943	64,010
Maine	13,578	59,435	11,715	60,544
Maryland	36,439	61,379	36,262	60,259
Massachusetts	54,312	93,771	54,446	70,199
Michigan	118,666	115,852	115,782	121,265
Minnesota	104,466	71,523	118,188	77,364
Mississippi	9,537	23,018	9,933	25,764
Missouri	72,937	76,996	76,532	73,969
Montana	22,215	2,597	18,181	2,483
Nebraska	53,462	61,046	54,895	69,217
Nevada	5,862	77,662	7,325	57,054
New Hampshire	4,581	54,901	4,595	58,899
New Jersey	113,268	163,750	101,507	139,183
New Mexico	7,954	22,622	9,501	22,414
New York	213,273	585,470	194,196	571,272
North Carolina	48,860	62,988	52,927	65,175
North Dakota	12,024	6,119	11,814	1,313
Ohio	208,826	167,616	193,744	127,302
Oklahoma	29,455	31,721	29,569	24,535
Oregon	64,196	401	73,751	401
Pennsylvania	138,986	148,733	129,659	108,985
Rhode Island	8,224	14,584	8,793	11,378
South Carolina	9,836	17,391	12,427	18,281
South Dakota	21,061	20,362	20,440	15,555
Tennessee	32,750	70,011	38,117	65,478
Texas	59,867	217,010	46,995	202,967
Utah	20,763	1,799	23,114	1,863
Vermont	5,375	18,617	6,432	24,929
Virginia	53,526	103,855	55,162	89,406
Washington	161,507	1,227	174,098	1,052
West Virginia	140,341	80,971	162,043	62,089
Wisconsin	125,357	43,489	128,073	44,311
Wyoming	10,908	2,419	8,886	3,611
Other [1]	180,800	270,683	230,719	143,662
Total	3,207,403	3,846,846	3,284,361	3,468,005

[1] Includes salt used in Puerto Rico (evaporated salt), shipments to noncontiguous Territories of the United States, exports, and some shipments to unspecified destinations.

Salt shipped to noncontiguous Territories of the United States, 1947–49

[U. S. Department of Commerce]

Territory	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Alaska	[1] 4,055	$119,614	(2)	(2)	(2)	(2)
American Samoa	2	285	1	$53	20	$821
Guam	133	3,899	98	4,202	51	3,556
Hawaii	2,810	90,495	(2)	(2)	(2)	(2)
Puerto Rico	6,711	345,681	7,000	407,883	6,651	397,918
Virgin Islands	85	5,447	41	2,669	36	2,688
Total	13,796	565,421	7,140	414,807	6,758	404,983

[1] Shipping weight.
[2] Data not available.

PRICES

At the point of production the average price of rock salt in 1949 was $4.64 per short ton in bulk and $9.46 per ton of blocks. Vacuum-pan evaporated in bulk was $9.72, solar salt $3.68, and evaporated blocks $12.02 a ton. The open-pan or grainer types of evaporated salt averaged $13.78. The latter figure includes products having a wide value range.

Prices quoted by Oil, Paint and Drug Reporter for common salt at New York City remained stable throughout 1949 as follows:

Prices of bagged salt in the United States in 1949, per 100 pounds

[Oil, Paint and Drug Reporter]

Rock salt, delivered, New York:	
Paper bags, carlots	$0.88
Burlap bags, carlots	.98
Paper bags, less than carlots	1.09–1.12
Burlap bags, less than carlots	1.19–1.22
Table, vacuum common fine, bags:	
Carlots, works	.98–1.08
Less than carlots, delivered, New York	1.20–1.32

In May 1949 another listing was added that appeared at times in the same journal as follows: Salt, USP,[9] in drums at 21 cents per pound.

Oil-drilling operations often reveal the existence of salt, and recent drilling in Western States has called attention to such findings and raised the question of their commercial value. The Paradox Valley formation, in which exploration has been carried on for years, extends from Colorado well into Utah. That part of the Paradox Valley formation that carries most of the salt is of the Pennsylvanian age, and the salt has usually been found at about 5,000 feet. Recent drilling showed that some of the salt occurred at a depth of 6,000 feet. However, no deposits that promise early commercial development have been reported. In Wyoming, ranchers are said to obtain some local surface salt for their cattle.

[9] United States Pharmacopoeia.

In other parts of the West, deposits such as those utilized in western Wyoming for cattle salt are worked for local use in a small way. In Missouri, a small operation supplies 4 or 5 barrels a day of crude salt, used locally for cattle. Such deposits are worked irregularly in New Mexico also.

FOREIGN TRADE [10]

Imports.—Only two countries supplied the slightly larger imports of salt in 1949 compared with those in 1948. Canada and Jamaica supplied almost equal tonnages. However, the value of the Canadian product—mostly table salt—was four times that of the Jamaican solar salt.

Salt imported for consumption in the United States, 1948–49, by countries

[U. S. Department of Commerce]

Country	1948		1949	
	Short tons	Value	Short tons	Value
Bahamas	697	$2,955		
Canada	1,878	26,441	3,264	$48,630
Jamaica	3,041	11,242	3,045	11,975
Leeward and Windward Islands	5	110		
Total	5,621	40,748	6,309	60,605

In 1949, no fish-curing salt was imported, following 768 tons imported in 1948. Most of the packaged fine salt from Canada was received through the Maine and New Hampshire customs (2,562 tons) whereas 215 tons were received by Hawaii; 8 tons by Alaska; and the remaining ton through Duluth and Superior Customs. The bulk salt from Canada totaled 433 tons through Michigan and 45 tons through Maine and New Hampshire customs office. Of the Jamaica salt, 65 tons of packaged salt was imported by Puerto Rico and all the bulk salt, 2,980 tons, through the Virginia customs.

Salt imported for consumption in the United States, 1945–49, by classes

[U. S. Department of Commerce]

Year	In bags, sacks, barrels, or other packages (dutiable) [1]		Bulk			
			Dutiable		Free (used in curing fish)	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	1,572	$36,343	2,981	$37,047		
1946	275	4,456	2,571	20,161	1,407	$5,011
1947	377	8,571	1,533	14,322		
1948	1,591	20,971	3,262	17,033	768	2,744
1949	2,851	40,308	3,458	20,297		

[1] Includes 1,500 pounds valued at $40 imported free in 1945 and 2,000 pounds valued at $20 in 1946.

[10] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Exports.—The 1949 exports declined 7 percent from those in 1948. The 1948 figures were revised to include additional exports of 8,613 tons to Japan and 10,067 tons to Korea. In 1949 salt exports to Japan increased still further, whereas those to Korea decreased.

As reported by producers to the Bureau of Mines, far more evaporated salt than rock salt was exported—roughly, over 200,000 tons of evaporated salt and over 140,000 tons of rock salt.

Salt exported from the United States, 1948–49, by countries

[U. S. Department of Commerce]

Country	1948		1949	
	Short tons	Value	Short tons	Value
North America:				
Bermuda	5	$336	11	$766
Canada	161,370	1,067,660	151,028	1,111,716
Central America:				
British Honduras	421	7,776	262	9,554
Canal Zone	978	42,688	710	35,159
Costa Rica	126	4,465	123	2,474
Guatemala	1,510	25,648	2,565	41,190
Honduras	206	5,195	298	8,226
Nicaragua	348	8,597	374	9,211
Panama	134	4,165	252	8,243
Mexico	6,675	548,283	7,267	164,689
Newfoundland and Labrador	6,698	35,585	300	3,794
West Indies:				
British:				
Jamaica	3	70	5	125
Other British	4	519	32	558
Cuba	7,409	150,984	9,095	191,534
Dominican Republic	96	7,218	99	6,411
Haiti	9	912	13	1,218
Netherlands Antilles	203	13,107	249	15,350
Other North America	50	1,040	111	2,122
South America:				
Argentina	100	1,589	1	222
Bolivia	3	305	24	857
Brazil	67	2,481	55	3,339
Chile	24	906	2	446
Surinam	231	6,046		
Uruguay			5	1,345
Venezuela	6	1,033	15	2,320
Other South America	1	294	3	529
Europe:				
Belgium and Luxembourg	26	2,218		
Greece			1	108
Iceland			1	168
Yugoslavia	1	129		
Asia:				
Hong Kong	61	1,790	83	2,309
Indonesia			19	1,990
Japan	[1] 119,353	[1] 3,522,696	131,304	986,992
Korea	[1] 77,568	[1] 325,784	51,558	596,169
Pakistan			30	6,898
Philippines	2,146	65,510	2,320	70,694
Saudi Arabia	59	2,300	110	5,549
Other Asia	59	2,435	35	2,010
Africa:				
Belgian Congo	26	1,504	23	1,286
Cameroon, French	155	5,067		
Liberia	1,206	54,470	1,087	48,707
Union of South Africa	33	2,410		
Other Africa	12	1,136	13	883
Oceania:				
French Pacific Islands	132	3,178	263	6,761
New Zealand	85	2,591	10	254
Other Oceania	2	50	20	939
Total	[1] 387,601	[1] 5,930,170	359,776	3,353,115

[1] Revised figure.

WORLD REVIEW

North America.—Following the United States, *Canada* ranks second on the continent in salt production. In 1949 about 53 percent of Canadian output was dry salt of commerce and 47 percent salt of brine. Ontario, with six operations, contributed 82 percent of the total and Alberta, Manitoba, and Nova Scotia the remainder. Ontario's output is divided almost equally between commercial salt and brine salt. In the former the preponderance is fine salt. New chlorine and caustic soda plants were added by an American company to its development in Ontario.[11] The plant of Alberta Salt Co., Lindbergh, Alberta, opened officially on March 19, 1949. The plant has been in operation since June 1948. Capacity is said to be about 150 tons per day.[12] The two wells at Neepawa, Manitoba, are still the basis for the entire salt industry of the Province, according to a short history of salt in the Province.[13]

World production of salt, 1944–49, by countries, in metric tons [1]

[Compiled by Helen L. Hunt]

Country [1]	1944	1945	1946	1947	1948	1949
North America:						
Canada	632,841	608,261	486,781	672,697	672,457	680,137
Costa Rica	6,197	6,033	8,000	6,252	6,500	(2)
Guatemala	12,645	(2)	(2)	(2)	[3] 10,614	11,962
Honduras	2,700	900	850	726	1,089	(2)
Mexico	126,267	130,380	131,972	122,235	[3] 156,685	(2)
Nicaragua	[3] 6,000	[3] 6,000	[3] 6,000	7,503	[3] 9,475	[3] 10,230
Panama	10,000	2,437	7,958	4,412	3,374	[3] 3,300
Salvador	13,328	18,004	22,680	16,483	21,213	(2)
United States:						
Rock salt	3,128,173	3,180,337	3,095,305	3,405,874	3,489,782	3,146,105
Other salt	11,130,131	10,784,920	10,632,274	11,157,887	11,390,957	10,997,464
West Indies:						
British:						
Bahamas	60,960	38,825	36,580	60,960	63,000	60,960
Turks and Caicos Islands	33,779	21,229	31,571	----------	38,610	(2)
Cuba	46,221	52,335	56,782	51,225	[3] 56,000	(2)
Dominican Republic	[3] 11,300	[3] 15,100	[3] 15,750	13,519	16,946	(2)
Haiti [3]	8,000	8,000	8,000	8,000	8,000	(2)
Netherlands Antilles	5,764	3,109	2,017	217	482	(2)
South America:						
Argentina:						
Rock salt	2,237	3,275	(2)	(2)	(2)	(2)
Other salt	449,038	433,116	384,000	384,000	(2)	(2)
Brazil	453,601	506,626	609,198	562,570	781,378	(2)
Chile:						
Rock salt	42,756	47,136	52,093	54,289	47,164	(2)
Other salt [3]	26,930	30,655	31,033	28,001	30,804	(2)
Colombia	133,862	105,072	124,367	121,247	124,981	[4] 52,573
Ecuador	35,958	27,600	35,070	24,943	[3] 23,000	(2)
Peru	53,818	55,143	56,615	60,108	60,002	60,000
Venezuela	44,792	57,459	90,555	35,794	35,533	71,000
Europe:						
Austria:						
Rock salt	3,600	(2)	554	4,348	1,752	(2)
Other salt	247,414	82,648	168,150	183,764	197,615	(2)
Bulgaria:						
Rock salt	(2)	(2)	13,659	(2)	[3] 120,000	(2)
Other salt	(2)	(2)	(2)	(2)		
Czechoslovakia [5]	(2)	4,235	9,232	(2)	(2)	(2)

See footnotes at end of table.

[11] Chemical Age (London), Continued Chemical Expansion: Vol. 60, No. 1548, Mar. 12, 1949, p. 397.
[12] Canadian Mining and Metallurgical Bulletin, Industrial Minerals Notes: Vol. 42, No. 444, April 1949, p. 189.
[13] Canadian Mining and Metallurgical Bulletin, Review of Industrial Mineral Developments in Manitoba: Vol. 42, No. 441, January 1949, p. 14.

World production of salt, 1944–49, by countries, in metric tons [1]—Continued

Country [1]	1944	1945	1946	1947	1948	1949
Europe—Continued						
France:						
Rock salt and salt from springs	546,323	642,378	1,514,470	2,148,140	(2)	(2)
Other salt	410,506	514,038	476,750	467,410	(2)	(2)
Germany	3,677,247	(2)	1,541,228	[6] 1,731,000	[6] 1,910,300	[6] 1,966,000
Greece	21,000	90,000	105,000	51,000	52,208	(2)
Italy:						
Rock salt	32,511	153,256	708,586	534,794	464,456	[3] 580,000
Other salt	450,867	995,103				
Malta	3,350	3,350	1,402	1,631	1,869	(2)
Netherlands	124,184	53,600	180,241	240,579	250,417	331,000
Poland	(2)	(2)	280,099	619,770	725,774	800,000
Portugal:						
Rock salt	80	71	46	69	(2)	(2)
Other salt [7]	3,425	7,769	82,974	25,071	(2)	(2)
Rumania: Rock salt	154,090	277,183	345,000	314,485	(2)	(2)
Spain:						
Rock salt	243,076	228,029	262,651	265,248	292,881	(2)
Other salt	449,058	562,453	510,121	569,343	696,600	(2)
Switzerland	84,689	82,657	92,089	95,435	112,218	(2)
United Kingdom:						
Great Britain:						
Rock salt	17,771	17,062	20,819	40,639	(2)	(2)
Other salt	3,407,791	3,268,083	3,385,540	3,148,639	(2)	(2)
Northern Ireland	11,220	12,679	13,474	12,603	13,245	(2)
Asia:						
Aden	208,603	142,191	114,856	197,672	275,408	308,302
Burma	(2)	[8] 34,243	[3] 56,000	(2)	(2)	(2)
Ceylon	28,686	42,364	43,666	23,231	78,300	(2)
China [3]	3,600,000	1,900,000	1,683,000	2,007,000	2,480,000	2,000,000
Formosa	169,724	[3] 100,000	191,850	[3] 250,000	[3] 360,000	250,000
Cyprus	5,334	(2)	[9] 3,429	15,622	(2)	(2)
French Indochina	148,100	100,983	[10] 14,735	41,556	64,000	(2)
India:						
Rock salt	205,776	256,366	266,447	4,605	4,243	[3] 2,600,000
Other salt	1,894,654	1,974,788	2,235,390	1,560,471	2,300,882	
Indonesia	431,000	130,452	80,000	12,000	130,000	(2)
Iraq:						
Rock salt	(2)	2,521	9,512	12,635	14,000	(2)
Other salt	11,792	12,364				
Israel-Jordan:						
Rock salt	1,181	2,144	1,571	2,454	(2)	(2)
Other salt	19,055	16,350	23,163	12,567	(2)	(2)
Japan	[11] 353,153	[11] 193,845	[11] 358,946	247,466	339,668	395,676
Korea	(2)	[3] 63,200	[3] 152,000	[3] 131,000	[12] 89,979	[12] 188,812
Lebanon	7,135	6,959	(2)	(2)	(2)	(2)
Pakistan	(13)	(13)	(13)	(13)	[14] 156,378	[14] 223,500
Portuguese India [7]	11,013	9,146	15,428	13,267	10,719	(2)
Syria	21,783	[3] 12,000	[3] 34,000	30,000	[3] 30,000	(2)
Thailand	108,131	41,393	137,601	(2)	(2)	(2)
Turkey:						
Rock salt	266,330	16,193	20,215	26,978	[3] 236,905	[3] 263,000
Other salt		255,303	186,088	249,865		
Africa:						
Algeria	50,937	49,969	66,570	75,680	13,038	(2)
Anglo-Egyptian Sudan	35,969	44,471	40,982	36,992	36,238	(2)
Angola	37,652	49,552	61,657	38,783	53,423	(2)
Belgian Congo	1,711	[3] 900	[3] 900	[3] 900	[3] 1,000	(2)
Canary Islands	14,869	16,302	13,659	6,956	(2)	(2)
Cape Verde Islands	17,525	7,886	14,376	9,246	(2)	(2)
Egypt [7]	199,116	255,107	226,090	622,629	359,823	[15] 343,416
Eritrea	10,954	27,056	40,967	45,722	(2)	(2)
Ethiopia: Rock salt [3]	10,000	10,000	10,000	10,000	(2)	(2)
French Morocco:						
Rock salt	34,945	31,730	8,570	10,480	15,566	34,100
Other salt			40,975	34,095	(2)	(2)
French Somaliland	42,657	55,000	45,000	48,000	60,000	60,000
French West Africa [3]	53,000	55,000	55,000	(2)	(2)	(2)
Italian Somaliland (formerly)	(2)	(2)	114	715	(2)	(2)
Kenya	14,054	15,491	15,635	14,058	16,813	(2)
Libya:						
Cyrenaica	(2)	(2)	700	200	140	(2)
Tripolitania			2,350	3,000	6,000	(2)
Mauritius	3,929	3,008	3,165	3,991	(2)	(2)
Mozambique	5,720	5,818	7,210	8,663	(2)	(2)
Nigeria	[3] 400	(2)	(2)	(2)	(2)	(2)

See footnotes at end of table.

World production of salt, 1944–49, by countries, in metric tons [1]—Continued

Country [1]	1944	1945	1946	1947	1948	1949
Africa—Continued						
South-West Africa:						
Rock salt	2,870	3,238	3,533	2,788	4,207	[15] 1,433
Other salt	9,049	10,011	10,590	9,861	10,612	[15] 10,190
Tanganyika	10,166	9,502	13,373	10,837	12,073	(2)
Tunisia	52,478	61,289	93,400	114,790	98,029	(2)
Uganda	(2)	(2)	5,679	7,003	7,011	(2)
Union of South Africa [16]	123,563	140,491	143,677	(2)	(2)	(2)
Australia:						
South Australia	167,531	173,813	160,753	157,563	175,865	[4] 84,615
Australia, other	(2)	(2)	(2)	(2)	88,308	(2)
Total [17]	40,400,000	36,000,000	38,335,000	38,751,000	42,488,000	(2)

[1] In addition to the countries listed, salt is produced in Afghanistan, Albania, Bolivia, British Somaliland, Gold Coast, Hungary, Iran, Leeward Islands, Madagascar, Philippines, Southern Rhodesia, U. S. S. R., and Yugoslavia, but figures of production are not available. Russian production is known to exceed 4,000,000 metric tons annually. Estimates by senior author of chapter included in the total.
[2] Data not available; estimates by author of the chapter included in total (except 1949).
[3] Estimate.
[4] January to June, inclusive.
[5] Excludes Sub-Carpathia, ceded to Hungary and U. S. S. R.
[6] Bizonal area.
[7] Exports.
[8] January to April, inclusive.
[9] Incomplete data.
[10] Cochin-China only.
[11] Fiscal year ended Mar. 31 of year following that stated.
[12] South Korea only.
[13] Included under India.
[14] Punjab only.
[15] January to September, inclusive.
[16] Fiscal year ended June 30 of year stated.
[17] Estimated by senior author of chapter.

No salt production was shown in Saskatchewan in preliminary official Canadian reports, but a recent article [14] reported the opening of a new salt refinery at Unity, Saskatchewan, by the Prairie Salt Co., Ltd., the first refinery of its kind in the Province. The output is to include free-flowing salt and high-grade salt for meat-packing and other industries, as well as salt with iodine and cobalt in loose form and compressed blocks for livestock feeding. The Dominican Information Center, New York, N. Y., announced in June 1949 that the *Dominican Republic* plans to increase its output of salt from the rock-salt mines in Barahona Province to 200,000 tons annually within the next 3 years. The goal for the first year (45,000 tons) is to be doubled the second year. Concurrently the Government planned to expand the Puerto Hermoso salt mines, Trujillo-Valdes Province, until 70,000 to 100,000 tons are produced.

South America.—In January 1949, it was announced [15] that, in an attempt to develop the alkali industry in *Brazil*, an agreement was entered into between the owner of a rock-salt deposit at Contiguiba, Sergipe State, and the Companhia Nacional de Alcalis and Industrias Brasileiras Alcalinas S. A. The deposit was estimated to have 100 million metric tons of salt. The first-named company planned to build its alkali plant at Cabo Frio and the second company at Sergipe near the salt beds. The companies were to have equal access to the

[14] Canadian and Process Industries, Salt Refining Opens in Saskatchewan: Vol. 33, No. 8, August 1949, p. 704.
[15] Chemical and Engineering News, Development of Alkali Industry in Brazil: Vol. 27, No. 4, Jan. 24, 1949, p. 241.

salt beds. Brazil produces salt in less than a dozen locations, all in the coastal area. About 80 percent of the annual output is from the State of Rio Grande do Norte. In the interest of promoting and improving Brazil's salt production, a civil engineer and representative of the Brazilian National Institute of Salt visited the United States in the winter of 1948–49 and toured salt operations in the eastern and central parts of the country. He reported upon his study in 1949.[16] In *Chile* the production of salt evaporated from sea water and from underground water increased in the last decade, but the output of rock salt still predominates according to recent reports.[17] Argentina, Brazil, and Uruguay are Chile's best salt customers. Reserves are said to be large and output expandable when required. However, it is said that outward-bound ships from Europe to Argentina or Uruguay for shipments of meat or cereals use salt picked up as ballast at Cadiz, Spain, or other European ports and unload it at prices with which Chile is unable to compete. In Chile, the f. a. s. port of embarkation price for common salt is about $10 to $10.50 per sack of 165 pounds. Production of salt in *Netherlands Antilles* has almost ceased on Curaçao and is declining on the other islands of this group.

Europe.—In November 1949 a salt cartel was formed in Europe to include *Italy* and *Spain* with *France* and the *French colonies* Somaliland, West Africa, Morocco, and Tunisia. Expansion plans of the producers in other countries, especially Turkey, are understood to have hastened the formation of the cartel. It is of the "syndicate" type, involving a central sales company incorporated in Tangier.[18] No further development of the salt deposits discovered a few years ago in *Denmark* was reported in 1949. Annual consumption in Denmark has ranged from 85,000 to 100,000 tons, all of which is imported from European sources, chiefly Germany. The German salt is apparently industrial salt, and smaller quantities of finer grades are supplied by Great Britain and the Netherlands. The uses to which the salt are applied follow: 25 percent household, 25 percent slaughter houses, 15 percent tanneries, 5 percent fishing industry, 5 percent dairies, and 25 percent other industries. According to reports from the Office of Military Government for Germany (United States),[19] the output of chemicals from salt in *Germany* increased greatly in 1948 compared with earlier years. Caustic soda production was 63 percent and chlorine output was 39 percent higher than in 1936. Salt from German deposits was utilized. Salt is listed among the principal commodities to be imported by *Iceland* from *Spain* under a trade agreement signed December 17, 1949. Production data on sea salt in *Italy* from 1891 to 1947 were published in 1949.[20] Output of sea salt for years consistently ran larger than the rock-salt production. According to the press,[21] the Direction of Italian Monopolies, which controls salt production, proposes to increase the output from the principal salt bed in Italy, the Margherita di Savoia, 6 miles

[16] Leonardos, Othon Henry, A Mineracao de Salgema no Nordeste dos Estados Unidos: Mineracao e Metalurgia, vol. 13, No. 78, March–April 1949, pp. 307–312.
[17] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 2, August 1949. p. 51; vol. 30, No. 2, February 1950, pp. 45–46.
[18] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 2, February 1950, p. 47; No. 3, March 1950, p. 45.
[19] Bureau of Mines, Mineral Trade Notes: Vol. 28, No. 3, March 1949, p. 35.
[20] Annuario Statistico Italiano, 1944–48, series 5, vol. 1. A table from this report appeared in Bureau of Mines, Mineral Trade Notes: Vol. 28, No. 6, June 1949, pp. 39–40.
[21] Chemical Age (London), Oct. 9, 1948, p. 492.

from the port of Barletta, to 500,000 tons annually. Revival of salt exports from this port is one objective. Yearly output from the bed is roughly 300,000 tons. Salt output in the *Netherlands* is increasing. The Royal Netherlands Salt Industry, Ltd., controls the country's salt industry. About 60 percent of the 1948 production was exported. Salt also was imported (about 100,000 tons) in the same year, from Germany, France, North Africa, and Italy. New salt deposits have been found near Trelleborg, Scania, *Sweden*, according to the Swedish Board of Trade.[22] Two wells are expected to produce more than 100,000 tons of salt yearly. Present Swedish salt consumption is said to be about 300,000 tons. *Switzerland* rather consistently produces about 100,000 metric tons of salt. Enough table salt for domestic requirements is produced, and normally a slight excess is exported.[23] "Kitchen salt" for industrial use is imported almost entirely from France. In 1947 imports of this type of salt totaled 248,000 tons and in 1948, 275,000 tons.

Asia.—*Arabia* has increased its salt exports to Korea. *China* held a 10-day conference in December 1949 to reorganize the salt administration. Attempts were made to increase salt production in Formosa in 1949, but the statistics do not show increased output. The operations are 50-percent Government-owned. Plans were made to supply Japan 500,000 metric tons in 1950. In *India* efforts are being made to increase salt production to self-sufficiency and to eliminate salt imports in 1950. The Central Advisory Committee is considering extensive development of salt works in the Kathiawar area to increase supplies materially. The zonal system of distribution was discussed, some manufacturers believing abolition of this system would remedy such scarcity as was experienced in 1949. Prices rose as a result of local scarcity. The Government also sought to increase production of sea salt which would contribute to expansion of the chemical industries. It is said that the price of salt will have to be lowered before it will be possible to build an alkali industry. *Japan's* salt production is partly by Government-licensed plants and partly by private, nonlicensed works. Since April 1945 output of salt has been permitted outside the Government monopoly system. The output of the nonlicensed plants is sold in the free market. The number of such producers is large, but their annual output appears to be irregular. During the past few years Japan has increased its salt imports. In 1949, in addition to large imports from the United States, Japan imported salt from Egypt, Italy, Indonesia, Thailand, China, and a number of other countries. *South Korea* approached a production of 200,000 tons in 1949 and imported about the same quantity. The United States supplied a sizable quantity, and some was obtained from Egypt, Arabia, and elsewhere. Reports giving details on the salt industry in Korea were published.[24] *Pakistan* and India signed an agreement to run from July 1949 to June 1950, whereby Pakistan was to supply India 700,000 tons of rock salt, but owing to lack of monetary adjustment following devaluation of India's currency in September 1949, the expected salt shipments were not actually made in

[22] Chemical Age (London), vol. 60, No. 1548, Mar. 12, 1949, p. 403.
[23] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 5, November 1949, p. 41.
[24] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 6, December 1949, p. 38.

1949. Pakistan deposits of salt, especially in the Salt Range (West Punjab),[25] are large and important to the economy of the country. The Institute of Science, *Republic of the Philippines*, in cooperation with the Fish and Wildlife Service, United States Department of the Interior, published a report [26] on the salt industry and tests that were conducted on salt plots in the Philippines. *Turkey* is endeavoring to increase its salt production by developing a large solar-salt area from which raw salt is easily available, the greatest obstacle to overcome being poor transportation to the sea. Technical assistance financed by the United States Economic Cooperation Administration in modernization of two of Turkey's largest salt-producing plants in 1949 is expected to result in an increase in production to more than 400,000 tons. The *U.S.S.R.* deposits and production are known to be large, but accurate statistics are not available. Russian shipping hauled salt consignments from Poland to distant ports in 1949.

Africa.—*Egypt* is stepping up its salt exports to Korea, but its exports to Japan declined greatly. Salt shipments (which declined in 1948 from 1947) nevertheless were higher than those before World War II. On September 30, 1949, the 50-year lease of the Port Said Salt Association, Ltd., from the Egyptian Government expired but was extended for another year.[27] Some of the African countries have failed to resume their former production, notably *Libya* and *Italian Somaliland* (formerly). The last-named at one time produced annually about 200,000 tons of salt, almost all of which was exported. The output now is negligible, as the salt works at Dante have never been restored since most of them were dismantled and moved away in 1940. Italian Somaliland sold salt a little over a decade ago to Japan. Part of *Uganda's* ten-year development plan includes improvement and enlargement of existing native salt works at Lake Katwe.[28] In the *Union of South Africa* a new salt industry was established upon completion of a plant at Jacob's Bay in September 1949, financed entirely by South African capital. The plant, the first in the country and reported [29] to be the third largest of its kind in the world, will produce common salt and other salines and metals. It is expected that enough table and industrial salt to meet the Union's needs and provide substantial exports will be produced, and that output by the end of the first year will reach 200,000 tons. Recent production figures for the Union of South Africa are not available, but in 1948 it was reported [30] that total salt output from the South African pans (only source in the past) averaged 190,000 tons a year from 25 pans.

[25] Gee, E. R., On the Problem of the Saline Series, Salt Range, Punjab; Abs. Proc. Geol. Soc. London, No. 1453 (Session 1948–49), Aug. 11, 1949, p. 114.
[26] Hamm, W. S., Purer Salt for the Philippines: Inst. Science Spec. Bull., Manila, October 1949, abs. in Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 2, February 1950, p. 47.
[27] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 5, November 1949, pp. 40–41.
[28] Bureau of Mines, Mineral Trade Notes: Vol. 28, No. 4, April 1949, pp. 41–45.
[29] Chemical and Engineering News, Promising New Salt Industry in Africa: Vol. 27, No. 20, May 16, 1949, p. 1466.
[30] Mines Department, Union of South Africa, Industrial Minerals Quarterly Information Circular, April–June 1948, p. 65.

Oceania.—In *Australia* the salt production is from lake deposits and sea water—no rock salt. The operations in the State of Victoria were described in an article [31] that contained illustrations of the evaporation basins, removal of thatch from a salt stack of about 2,500 tons, shovel-loading crude salt for transport to refinery, inner condensers and salt stack, and silos for crude salt outside the refinery. Most of the salt from the lake deposits is used for agricultural and industrial purposes. In many instances the purchaser collects his own salt and pays the leaseholder £3/12 per ton. The size of the annual output is influenced greatly by the weather. Cobalt for soil deficiency is added to the salt blocks. In *New Zealand*, in 1949, a company with Government participation planned to start work on a solar-salt works at Lake Grassmere, South Island, using methods similar to those employed at San Francisco Bay, Calif. Within a few years an annual output of 25,000 tons is expected, and later 50,000 tons.

[31] Bain, A. D. N., Salt Production in Victoria: Min. and Geol. Jour., vol. 3, No. 6, September 1949, pp. 4–7.

Sand and Gravel

By D. G. Runner and G. E. Tucker

GENERAL SUMMARY

PRODUCTION of sand and gravel in 1949 declined slightly from the record 1948 level, but the output was still well above the previous record established in 1942. As indicated in figure 1, the value of sand and gravel produced exceeded the 200-million-dollar mark for the third consecutive time.

In this chapter the terms "production" and "sales" are used interchangeably, inasmuch as stocks of sand and gravel are relatively small and fairly constant from year to year.

As shown in the accompanying salient statistics table, sales in 1949 of industrial sands by commercial operators differed widely from the 1948 figures. Sales of molding and engine sand showed the greatest decreases, while the output of glass, grinding and polishing, and fire or furnace sand was only slightly below 1948 levels. Sales of sand for building were virtually unchanged, while increases were recorded in the sales of all other classes of material. Production of gravel by commercial operators increased for all classes with the exception of material used for railroad ballast. Output of this gravel was about three-fourths of the 1948 production. The combined total of sand and gravel used on Government-and-contractor operations was higher than in 1948, all types of material registering increases except building gravel.

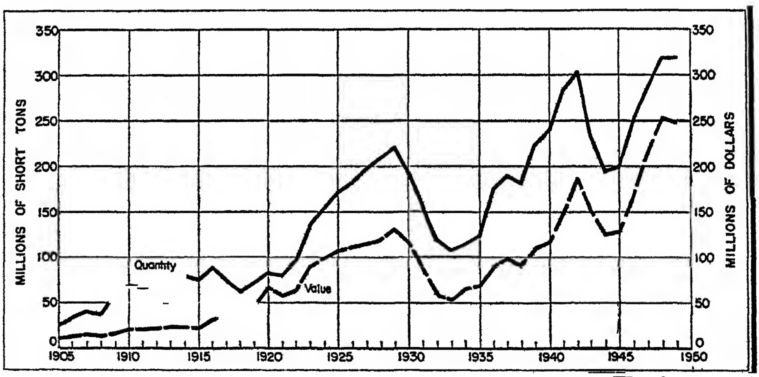

FIGURE 1.—Production of sand and gravel in the United States, 1905–49.

Sand and gravel sold or used by producers in the United States, 1948–49, by commercial and Government-and-contractor operations and by uses

	1948			1949			Percent of change in—	
	Short tons	Value: Total	Value: Average	Short tons	Value: Total	Value: Average	Tonnage	Average value
COMMERCIAL OPERATIONS								
Sand:								
Glass	4,542,260	$10,770,845	$2.37	4,339,033	$10,772,151	$2.48	−4.5	+4.6
Molding	8,265,451	12,892,392	1.56	6,113,520	10,140,458	1.66	−26.0	+6.4
Building	59,357,062	47,102,476	.79	59,307,353	47,879,130	.81	−.1	+2.5
Paving	31,127,243	25,018,409	.80	31,520,407	25,849,473	.82	+1.3	+2.5
Grinding and polishing [1]	1,119,802	2,151,095	1.92	1,080,886	2,063,866	1.91	−3.5	−.5
Fire or furnace	322,576	492,128	1.53	318,373	429,512	1.35	−1.3	−11.8
Engine	2,445,454	2,439,135	1.00	1,883,580	1,830,549	.97	−23.0	−3.0
Filter	158,269	382,600	2.42	189,243	376,596	1.99	+19.6	−17.8
Railroad ballast [2]	869,699	374,498	.43	955,996	407,234	.43	+9.9	------
Other [3]	1,588,814	2,027,982	1.28	2,300,240	1,961,224	.85	+44.8	−33.6
Total commercial sand	109,796,630	103,651,560	.94	108,008,631	101,710,193	.94	−1.6	------
Gravel:								
Building	48,679,419	48,315,368	.99	49,788,200	49,319,528	.99	+2.3	------
Paving	58,775,303	49,639,057	.84	60,571,091	52,972,235	.87	+3.1	+3.6
Railroad ballast [4]	14,033,722	7,888,283	.56	10,444,070	5,618,124	.54	−25.6	−3.6
Other [5]	2,218,448	1,825,464	.82	2,393,486	1,716,039	.72	+7.9	−12.2
Total commercial gravel	123,706,892	107,668,172	.87	123,196,847	109,625,926	.89	−.4	+2.3
Total commercial sand and gravel	233,503,522	211,319,732	.90	231,205,478	211,336,119	.91	−1.0	+1.1
GOVERNMENT-AND-CONTRACTOR OPERATIONS [6]								
Sand:								
Building	1,529,000	811,000	.53	1,604,000	959,000	.60	+4.9	+13.2
Paving	7,336,000	3,452,000	.47	7,424,000	2,820,000	.38	+1.2	−19.1
Total Government-and-contractor sand	8,865,000	4,263,000	.48	9,028,000	3,779,000	.42	+1.8	−12.5
Gravel:								
Building	5,487,000	3,405,000	.62	3,133,000	2,235,000	.71	−42.9	+14.5
Paving	71,411,000	33,510,000	.47	75,738,000	31,093,000	.41	+6.1	−12.8
Total Government-and-contractor gravel	76,898,000	36,915,000	.48	78,871,000	33,328,000	.42	+2.6	−12.5
Total Government-and-contractor sand and gravel	85,763,000	41,178,000	.48	87,899,000	37,107,000	.42	+2.5	−12.5
COMMERCIAL AND GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand	118,661,000	107,915,000	.91	117,036,000	105,489,000	.90	−1.4	−1.1
Gravel	200,605,000	144,583,000	.72	202,068,000	142,954,000	.71	+.7	−1.4
Grand total	319,266,000	252,498,000	.79	319,104,000	248,443,000	.78	−.1	−1.3

[1] Includes blast sand as follows—1948: 381,455 tons valued at $1,189,530; 1949: 393,427 tons, $1,222,513.
[2] Includes ballast sand produced by railroads for their own use as follows—1948: 87,684 tons valued at $7,321; 1949: 169,219 tons, $13,748.
[3] Includes some sand used by railroads for fills and similar purposes as follows—1948: 197,379 tons valued at $34,213; 1949: 406,344 tons, $101,177.
[4] Includes ballast gravel produced by railroads for their own use as follows—1948: 5,126,293 tons valued at $1,823,741; 1949: 4,406,251 tons, $1,748,602.
[5] Includes some gravel used by railroads for fills and similar purposes as follows—1948: 1,145,673 tons valued at $478,962; 1949: 759,841 tons, $240,217.
[6] Approximate figures for States, counties, municipalities, and other Government directly or under lease.

PRODUCTION

The production of sand and gravel in 1949 totaled 319,104,000 short tons valued at $248,443,000, a decrease of 0.1 percent in quantity and 2 percent in value compared with the output of 319,266,000 tons valued at $252,498,000 in 1948. In general, industrial consumption slumped somewhat, but sand and gravel continued to benefit from the high rate maintained in construction activity during the year.

In 1949 California was the largest producer, followed by Michigan, New York, Illinois, Wisconsin, Texas, Ohio, Minnesota, and Pennsylvania in the order named. These nine States, each with an output exceeding 11,000,000 short tons, accounted for 51 percent of the total production.

The following tables show details of production, by States and uses, in 1949.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States, 1945–49

Year	Sand		Gravel (including railroad ballast)		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	71,726,000	$54,856,000	123,798,000	$73,981,000	195,524,000	$128,837,000
1946	96,440,000	74,975,000	157,691,000	96,411,000	254,131,000	171,386,000
1947	108,719,000	94,154,000	178,940,000	122,715,000	287,659,000	216,869,000
1948	118,661,000	107,915,000	200,605,000	144,583,000	319,266,000	252,498,000
1949	117,036,000	105,489,000	202,068,000	142,954,000	319,104,000	248,443,000

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1949, by States

State	Short tons	Value	State	Short tons	Value
Alabama	3,296,582	$2,268,013	New Hampshire	[1] 2,000,842	[1] $236,895
Alaska	(1)	(1)	New Jersey	[1] 5,555,121	[1] 6,981,862
Arizona	1,511,953	970,813	New Mexico	883,223	610,839
Arkansas	[1] 2,507,244	[1] 2,128,474	New York	18,543,071	15,116,820
California	36,279,816	30,198,924	North Carolina	5,092,929	3,553,180
Colorado	4,751,431	2,964,588	North Dakota	4,370,521	1,638,293
Connecticut	2,648,343	1,587,446	Ohio	14,955,657	14,428,820
Delaware	233,977	196,451	Oklahoma	2,921,157	1,525,415
Florida	2,243,898	1,879,733	Oregon	7,134,751	7,682,272
Georgia	[1] 984,488	[1] 757,680	Pennsylvania	11,698,939	14,398,577
Idaho	3,271,362	2,286,609	Puerto Rico	(1)	(1)
Illinois	17,128,144	14,780,487	Rhode Island	398,487	378,896
Indiana	8,887,231	6,695,426	South Carolina	[1] 287,108	[1] 145,142
Iowa	7,978,229	4,446,661	South Dakota	5,456,742	2,315,430
Kansas	6,186,719	3,327,920	Tennessee	4,056,398	4,054,463
Kentucky	2,375,906	2,168,626	Texas	14,997,506	13,467,849
Louisiana	[1] 5,050,148	[1] 6,107,311	Utah	2,331,688	1,553,408
Maine	4,605,172	1,393,676	Vermont	1,581,614	728,394
Maryland	[1] 4,776,815	[1] 6,028,791	Virginia	4,412,583	4,049,157
Massachusetts	5,504,841	4,379,030	Washington	9,215,914	6,391,412
Michigan	20,475,996	13,992,903	West Virginia	[1] 3,284,805	[1] 5,491,274
Minnesota	12,935,392	4,903,908	Wisconsin	17,023,466	10,456,561
Mississippi	[1] 1,942,941	[1] 1,330,413	Wyoming	2,352,493	1,912,838
Missouri	5,193,672	4,346,681	Undistributed [1]	6,635,000	4,695,000
Montana	6,682,144	3,365,472			
Nebraska	5,114,766	2,911,734	Total	319,104,000	248,443,000
Nevada	1,346,608	1,212,166			

[1] Output of commercial producers in Alaska and New Hampshire and of Government-and-contractor operations in Alaska, Arkansas, Georgia, Louisiana, Maryland, Mississippi, New Jersey, Puerto Rico, South Carolina, and West Virginia comprises "Undistributed."

Sand or gravel sold or used by commercial and Government-and-contractor producers in the United States in 1949, by States and uses

[Commercial unless otherwise indicated]

State	Sand							
	Glass		Molding		Building			
					Commercial		Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	----	----	57,081	$100,692	639,012	$417,434	----	----
Alaska	----	----	----	----	(1)	(1)	(1)	(1)
Arizona	----	----	----	----	295,132	284,041	49	$70
Arkansas	72,404	$146,663	24,135	48,888	540,100	365,334	----	----
California	(1)	(1)	33,001	76,125	9,762,512	7,786,352	133,041	100,729
Colorado	----	----	----	----	343,332	317,077	50,070	72,293
Connecticut	----	----	----	----	640,978	483,504	681,542	48,682
Delaware	----	----	----	----	38,522	25,194	----	----
Florida	----	----	----	----	1,165,458	988,183	----	----
Georgia	17,992	35,984	49,517	75,555	451,461	232,711	(1)	(1)
Idaho	----	----	----	----	147,448	147,778	35,085	9,882
Illinois	(1)	(1)	849,790	1,643,826	3,399,853	2,460,706	1,500	1,000
Indiana	----	----	431,938	463,920	1,018,184	762,152	----	----
Iowa	----	----	----	----	1,283,240	955,208	----	----
Kansas	----	----	----	----	1,843,086	1,084,378	1,641	846
Kentucky	----	----	(1)	(1)	417,747	376,647	----	----
Louisiana	----	----	60,490	53,769	832,245	691,555	(1)	(1)
Maine	----	----	----	----	41,956	19,312	2,025	375
Maryland	(1)	(1)	----	----	1,007,047	1,063,807	----	----
Massachusetts	----	----	(1)	(1)	1,745,811	1,355,903	540	200
Michigan	(1)	(1)	1,504,858	1,147,489	2,009,857	1,456,675	25	40
Minnesota	(1)	(1)	(1)	(1)	1,610,519	1,169,478	17,640	7,056
Mississippi	----	----	----	----	478,797	268,765	(1)	(1)
Missouri	316,423	654,615	(1)	(1)	1,044,460	735,585	----	----
Montana	----	----	----	----	166,939	217,664	60,527	77,436
Nebraska	----	----	(1)	(1)	375,109	229,819	716	393
Nevada	(1)	(1)	33,791	59,467	68,807	94,067	48,559	55,512
New Hampshire	----	----	----	----	(1)	(1)	----	----
New Jersey	(1)	(1)	1,172,923	2,531,531	1,496,999	1,285,816	----	----
New Mexico	----	----	----	----	265,333	183,818	335	385
New York	----	----	358,653	731,941	7,387,798	5,630,544	91,270	88,334
North Carolina	----	----	----	----	740,037	452,603	126,400	63,200
North Dakota	----	----	----	----	151,777	130,100	800	680
Ohio	(1)	(1)	604,881	1,315,487	3,596,045	3,273,115	675	300
Oklahoma	(1)	(1)	(1)	(1)	458,270	248,831	10,571	1,795
Oregon	----	----	2,700	1,176	945,850	1,042,184	2,266	1,205
Pennsylvania	(1)	(1)	260,902	621,924	3,756,941	3,961,688	----	----
Puerto Rico	----	----	----	----	----	----	(1)	(1)
Rhode Island	----	----	(1)	(1)	98,148	92,634	----	----
South Carolina	----	----	----	----	174,802	67,300	----	----
South Dakota	----	----	----	----	257,409	217,660	30,631	28,823
Tennessee	(1)	(1)	(1)	(1)	898,158	981,994	----	----
Texas	(1)	(1)	(1)	(1)	2,772,629	2,163,019	3,334	4,643
Utah	----	----	(1)	(1)	254,750	185,385	774	1,218
Vermont	----	----	----	----	31,755	19,496	4,273	5,805
Virginia	(1)	(1)	2,857	1,823	695,180	598,160	----	----
Washington	3,450	19,200	(1)	(1)	1,234,578	924,912	11,327	5,170
West Virginia	(1)	(1)	(1)	(1)	463,201	660,081	(1)	(1)
Wisconsin	----	----	(1)	(1)	2,077,769	1,587,506	47,681	27,679
Wyoming	----	----	----	----	34,406	53,893	126,428	196,067
Undistributed [1]	3,928,764	9,915,689	666,003	1,266,845	147,906	129,062	114,000	159,000
Total	4,339,083	10,772,151	6,113,520	10,140,458	59,307,353	47,879,130	1,604,000	959,000

[1] Figures that may not be shown separately are combined as "Undistributed."

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1949, by States and uses—Continued

State	Sand—Continued							
	Paving				Grinding and polishing [2]		Fire or furnace	
	Commercial		Government-and-contractor					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	382,963	$284,850	140,491	$116,965	----	----	----	----
Alaska	----	----	(1)	(1)	----	----	----	----
Arizona	18,640	21,689	37,233	9,688	----	----	----	----
Arkansas	374,950	257,165	(1)	(1)	9,070	$5,442	----	----
California	3,890,081	2,990,668	650,324	473,069	51,646	162,110	----	----
Colorado	15,316	18,895	15,890	3,187	200	326	----	----
Connecticut	330,280	234,546	16,200	3,000	----	----	----	----
Delaware	74,755	49,229	----	----	----	----	----	----
Florida	156,079	132,005	141,850	26,250	(1)	(1)	----	----
Georgia	259,616	160,330	(1)	(1)	45,321	101,179	----	----
Idaho	23,208	20,577	134,038	100,025	----	----	----	----
Illinois	2,816,478	2,149,705	23,909	16,862	(1)	(1)	(1)	(1)
Indiana	1,549,514	1,181,870	----	----	----	----	(1)	(1)
Iowa	413,522	309,623	13,488	8,063	(1)	(1)	----	----
Kansas	1,177,052	761,261	306,084	109,286	1,720	1,011	----	----
Kentucky	469,321	471,398	25	112	----	----	----	----
Louisiana	628,642	820,014	(1)	(1)	----	----	----	----
Maine	68,679	34,406	150,446	47,984	----	----	----	----
Maryland	1,438,447	1,711,725	(1)	(1)	----	----	768	$3,072
Massachusetts	610,698	447,453	74,964	36,204	(1)	(1)	17,710	10,825
Michigan	2,263,318	1,732,014	128,435	23,304	(1)	(1)	----	----
Minnesota	492,725	337,063	19,573	2,883	----	----	----	----
Mississippi	154,677	107,218	(1)	(1)	----	----	----	----
Missouri	669,168	437,833	16,405	11,037	(1)	(1)	----	----
Montana	100,330	85,780	98,689	19,987	----	----	----	----
Nebraska	238,761	112,834	48,736	21,725	(1)	(1)	----	----
Nevada	10,248	20,869	20,540	10,574	----	----	----	----
New Hampshire	(1)	(1)	352,070	41,308	----	----	----	----
New Jersey	1,196,539	884,019	(1)	(1)	58,425	203,304	12,200	20,817
New Mexico	----	----	----	----	(1)	(1)	----	----
New York	2,098,674	1,804,703	358,990	61,941	----	----	(1)	(1)
North Carolina	219,222	186,866	2,113,277	561,309	(1)	(1)	----	----
North Dakota	81,164	76,211	6,480	480	----	----	----	----
Ohio	1,934,162	1,672,516	700	515	(1)	(1)	(1)	(1)
Oklahoma	362,360	190,676	----	----	(1)	(1)	----	----
Oregon	328,342	325,081	139,091	244,202	(1)	(1)	----	----
Pennsylvania	1,421,459	1,623,740	300	510	269,533	506,933	43,857	82,187
Puerto Rico	----	----	(1)	(1)	----	----	----	----
Rhode Island	81,079	60,811	28,847	20,843	----	----	(1)	(1)
South Carolina	(1)	(1)	(1)	(1)	(1)	(1)	----	----
South Dakota	143,553	126,630	82,244	4,524	----	----	----	----
Tennessee	383,667	405,299	9,796	1,088	(1)	(1)	----	----
Texas	1,713,393	1,465,273	20,031	9,229	(1)	(1)	----	----
Utah	123,754	105,068	26,124	15,700	----	----	----	----
Vermont	23,314	14,235	225,031	54,073	(1)	(1)	----	----
Virginia	635,036	367,276	128,421	56,393	2,280	1,368	----	----
Washington	372,282	279,968	163,650	141,218	(1)	(1)	----	----
West Virginia	528,166	629,282	----	----	(1)	(1)	36,881	42,051
Wisconsin	1,075,719	682,967	1,180,516	336,629	(1)	(1)	----	----
Wyoming	15,036	19,798	49,548	44,483	----	----	----	----
Undistributed [1]	156,018	88,034	506,000	186,000	642,691	1,082,193	206,957	270,560
Total	31,520,407	25,849,473	7,424,000	2,820,000	1,080,886	2,063,866	318,373	429,512

[1] Figures that may not be shown separately are combined as "Undistributed."
[2] Includes 393,427 tons of blast sand valued at $1,222,513.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1949, by States and uses—Continued

State	Sand—Continued							
	Engine		Filter		Railroad ballast [3]		Other [4]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	10,000	$25,000				
Alaska	(1)	(1)						
Arizona	(1)	(1)					(1)	(1)
Arkansas	(1)	(1)			(1)	(1)	18,730	$425
California	27,229	$19,299	10,517	34,283	(1)	(1)	88,137	62,630
Colorado	26,030	30,159			(1)	(1)	(1)	(1)
Connecticut			(1)	(1)			28,325	12,330
Delaware	57,204	28,602						
Florida			625	1,000	(1)	(1)	11,891	10,261
Georgia	15,077	11,189	1,599	6,399			143,905	134,333
Idaho	60	50					(1)	(1)
Illinois	90,620	90,396	(1)	(1)	(1)	(1)	136,211	253,808
Indiana	145,860	81,717			57,777	$42,069	28,192	24,443
Iowa	54,114	46,965	(1)	(1)	(1)	(1)	68,876	47,536
Kansas	92,680	74,639	(1)	(1)	201,931	46,266	71,569	55,161
Kentucky	93,746	79,860					(1)	(1)
Louisiana	13,112	9,341			(1)	(1)		
Maine							(1)	(1)
Maryland	(1)	(1)					(1)	(1)
Massachusetts	27,040	18,190	(1)	(1)			37,651	24,597
Michigan	(1)	(1)			(1)	(1)	39,167	49,200
Minnesota	35,300	19,250			(1)	(1)	23,608	9,334
Mississippi	8,230	4,740						
Missouri	47,814	52,403	1,000	890	(1)	(1)	45,663	66,963
Montana							23,246	9,363
Nebraska	(1)	(1)	3,960	1,386	13,500	2,300	30,817	8,368
Nevada							(1)	(1)
New Hampshire	(1)	(1)						
New Jersey	(1)	(1)	47,782	124,589			6,087	10,585
New Mexico								
New York	(1)	(1)	53,734	36,071	35,185	15,921	111,319	66,493
North Carolina	20,000	18,000	(1)	(1)			(1)	(1)
North Dakota							(1)	(1)
Ohio	53,074	79,416	(1)	(1)	112,280	53,775	150,179	212,599
Oklahoma	45,864	27,009	(1)	(1)			(1)	(1)
Oregon	24,058	11,849			(1)	(1)	11,465	6,117
Pennsylvania	260,356	473,346	(1)	(1)			139,925	212,866
Puerto Rico								
Rhode Island							1,664	1,023
South Carolina	(1)	(1)	(1)	(1)			(1)	(1)
South Dakota					376	368	4,500	1,800
Tennessee	(1)	(1)	(1)	(1)	2,352	2,352	(1)	(1)
Texas	76,428	58,792	(1)	(1)	5,000	3,500	25,105	14,429
Utah	(1)	(1)	(1)	(1)			(1)	(1)
Vermont	2,267	1,792					13,220	9,153
Virginia	31,500	18,900			(1)	(1)	120,474	77,562
Washington					(1)	(1)	27,983	16,592
West Virginia	198,981	323,414					(1)	(1)
Wisconsin	20,000	12,000			67,564	25,871	44,163	19,758
Wyoming	2,616	3,052					1,020	680
Undistributed [1]	414,320	236,179	60,026	146,978	460,031	214,812	847,148	542,815
Total	1,883,580	1,830,549	189,243	376,596	955,996	407,234	2,300,240	1,961,224

[1] Figures that may not be shown separately are combined as "Undistributed."
[3] Includes 169,219 tons of ballast sand valued at $13,748, produced by railroads for their own use.
[4] Includes 406,344 tons of sand valued at $101,177, used by railroads for fills and similar purposes.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1949, by States and uses—Continued

State	Gravel							
	Building				Paving			
	Commercial		Government-and-contractor		Commercial		Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	601,029	$543,201			713,678	$643,385	546,556	$27,791
Alaska			(1)	(1)			(1)	(1)
Arizona	161,448	192,223	2,578	$5,220	212,175	187,497	699,139	161,257
Arkansas	423,191	431,773			777,600	707,640	(1)	(1)
California	8,954,533	8,086,483	255,094	169,775	5,717,458	5,264,046	6,089,770	3,825,880
Colorado	336,431	408,273	322,127	128,713	272,304	227,468	2,959,128	1,577,877
Connecticut	491,200	498,940			311,166	255,031	103,615	34,623
Delaware	23,692	37,155			39,804	56,271		
Florida	620,000	620,000			90,967	68,980		
Georgia			(1)	(1)			(1)	(1)
Idaho	231,967	224,680	31,630	21,051	584,842	567,925	1,948,383	1,170,685
Illinois	3,178,582	2,369,323	24,375	14,656	3,563,857	2,295,498	742,832	446,094
Indiana	1,183,260	1,053,399	30,000	5,000	3,217,073	2,418,792	428,549	170,769
Iowa	879,369	1,136,169			1,587,430	1,124,878	3,527,365	650,000
Kansas	178,721	150,901	44,688	9,115	1,002,161	665,108	973,331	264,940
Kentucky	393,903	468,733	16,200	9,000	277,476	290,510	594,429	411,683
Louisiana	1,245,081	1,459,604			2,093,662	2,915,246	(1)	(1)
Maine	56,607	44,963			162,289	119,706	3,953,517	1,047,831
Maryland	835,651	1,200,818			1,431,442	1,957,976	(1)	(1)
Massachusetts	1,637,976	1,656,108	1,890	380	758,138	610,998	483,524	73,745
Michigan	2,959,352	2,502,469	125,003	8,456	5,913,806	4,116,419	4,733,177	1,999,017
Minnesota	900,095	1,227,790	92,023	28,351	1,259,811	980,851	6,979,510	635,942
Mississippi	469,180	345,012	(1)	(1)	677,849	558,170	(1)	(1)
Missouri	720,998	579,507			1,081,284	845,710	719,021	428,239
Montana	240,142	242,344	232,123	230,852	1,039,513	859,718	4,182,555	1,224,009
Nebraska	1,106,488	628,892	640	331	2,714,252	1,625,883	487,630	228,465
Nevada	28,350	41,000	158,717	183,372	24,152	51,674	690,161	229,073
New Hampshire	(1)	(1)			65,596	86,436	1,648,772	195,587
New Jersey	619,442	691,558			503,866	467,011	(1)	(1)
New Mexico	272,356	202,009	320	227	(1)	(1)	129,500	63,034
New York	3,186,286	3,494,382	325,550	179,677	2,689,808	2,505,226	1,698,045	395,696
North Carolina	369,640	562,726			976,508	1,141,273	480,546	548,225
North Dakota	264,848	399,984	103,803	46,338	494,862	297,132	2,907,784	586,553
Ohio	2,391,594	2,319,501			4,062,226	3,426,260	472,118	159,144
Oklahoma	179,468	126,558	47,900	29,749	(1)	(1)	1,087,063	234,101
Oregon	1,447,738	1,460,343	1,696	2,990	2,173,162	2,261,663	1,786,413	2,089,013
Pennsylvania	3,002,973	3,429,487			1,491,233	1,663,624	315,477	82,330
Puerto Rico			(1)	(1)			(1)	(1)
Rhode Island	65,678	67,857			34,021	34,787	66,264	64,281
South Carolina								
South Dakota	131,516	97,201	1,854	2,548	914,296	838,639	3,796,558	939,972
Tennessee	806,406	1,009,749	102,456	56,040	760,935	656,279	789,055	350,112
Texas	3,660,922	4,257,202	4,936	4,949	3,355,057	3,561,827	1,574,139	450,854
Utah	342,058	240,281	47,892	17,124	480,998	349,068	902,285	536,780
Vermont	(1)	(1)	24,564	7,601	87,068	84,420	1,108,343	497,664
Virginia	743,583	1,075,633			1,267,735	1,487,375	684,452	210,011
Washington	2,081,217	1,488,583	30,885	25,934	1,457,486	1,413,484	3,002,954	1,762,893
West Virginia	427,180	576,423			681,828	803,424	(1)	(1)
Wisconsin	1,776,060	1,438,318	296,660	258,898	2,971,611	2,033,098	6,109,223	3,026,852
Wyoming	37,851	69,922	356,832	372,915	202,224	143,297	1,215,564	805,660
Undistributed [1]	124,138	162,051	451,000	415,000	376,382	302,532	5,121,000	3,487,000
Total	49,788,200	49,319,528	3,133,000	2,235,000	60,571,091	52,972,235	75,738,000	31,093,000

[1] Figures that may not be shown separately are combined as "Undistributed."

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1949, by States and uses—Continued

State	Gravel—Continued				Sand and gravel			
	Railroad ballast [5]		Other [6]		Total commercial		Total Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	48,000	$43,200	2,609,535	$2,123,257	687,047	$144,756
Alaska	----------	----------	----------	----------	(1)	(1)	(1)	(1)
Arizona	10,446	$4,417	(1)	(1)	772,954	794,578	738,999	176,235
Arkansas	208,088	124,202	(1)	(1)	2,507,244	2,128,474	(1)	(1)
California	172,172	104,869	178,080	103,918	29,151,587	25,629,471	7,128,229	4,569,453
Colorado	57,283	36,553	----------	----------	1,404,216	1,182,518	3,347,215	1,782,070
Connecticut	(1)	(1)	28,367	9,697	1,846,986	1,501,141	801,357	86,305
Delaware	----------	----------	----------	----------	233,977	196,451	----------	----------
Florida	----------	----------	----------	----------	2,102,048	1,853,483	141,850	26,250
Georgia	----------	----------	----------	----------	984,488	757,680	(1)	(1)
Idaho	127,516	17,425	(1)	(1)	1,122,226	984,966	2,149,136	1,301,643
Illinois	995,633	548,217	16,714	8,569	16,335,528	14,301,875	792,616	478,612
Indiana	493,413	348,268	(1)	(1)	8,428,682	6,519,657	458,549	175,769
Iowa	89,237	74,790	15,947	27,666	4,437,376	3,788,598	3,540,853	658,063
Kansas	260,576	78,572	(1)	(1)	4,860,975	2,943,733	1,325,744	384,187
Kentucky	111,247	55,507	(1)	(1)	1,765,252	1,747,831	610,654	420,795
Louisiana	(1)	(1)	(1)	(1)	5,050,148	6,107,311	(1)	(1)
Maine	(1)	(1)	4,486	1,695	499,184	297,486	4,105,988	1,096,190
Maryland	----------	----------	22,735	17,278	4,776,815	6,028,791	(1)	(1)
Massachusetts	(1)	(1)	(1)	(1)	4,943,923	4,268,501	560,918	110,529
Michigan	290,656	246,047	35,843	25,940	15,489,356	11,962,086	4,986,640	2,030,817
Minnesota	1,089,117	335,604	391,589	104,839	5,826,646	4,229,676	7,108,746	674,232
Mississippi	154,208	46,508	----------	----------	1,942,941	1,330,413	(1)	(1)
Missouri	263,961	167,480	7,200	2,667	4,458,246	3,907,405	735,426	439,276
Montana	464,297	343,047	73,783	55,272	2,108,250	1,813,188	4,573,894	1,552,284
Nebraska	(1)	(1)	(1)	(1)	4,577,044	2,660,820	537,722	250,914
Nevada	163,506	114,897	----------	----------	428,631	733,635	917,977	478,531
New Hampshire	----------	----------	18,000	18,000	(1)	(1)	2,000,842	236,895
New Jersey	(1)	(1)	55,185	108,392	5,555,121	6,981,862	(1)	(1)
New Mexico	(1)	(1)	----------	----------	753,068	547,193	130,155	63,646
New York	(1)	(1)	65,170	47,208	16,074,216	14,391,172	2,468,855	725,648
North Carolina	(1)	(1)	----------	----------	2,372,706	2,380,446	2,720,223	1,172,734
North Dakota	(1)	(1)	71,922	30,447	1,351,654	1,004,242	3,018,867	634,051
Ohio	910,855	580,571	381,862	466,465	14,482,164	14,268,861	473,493	159,959
Oklahoma	----------	----------	(1)	(1)	1,775,623	1,259,770	1,145,534	265,645
Oregon	231,001	202,084	38,607	32,484	5,205,285	5,344,862	1,929,466	2,337,410
Pennsylvania	(1)	(1)	41,263	57,690	11,383,162	14,315,737	315,777	82,840
Puerto Rico	----------	----------	----------	----------	----------	----------	(1)	(1)
Rhode Island	----------	----------	(1)	(1)	303,376	293,772	95,111	85,124
South Carolina	(1)	(1)	----------	----------	287,108	145,142	(1)	(1)
South Dakota	68,030	25,210	25,775	32,055	1,545,455	1,339,563	3,911,287	975,867
Tennessee	(1)	(1)	(1)	(1)	3,155,091	3,647,223	901,307	407,240
Texas	1,580,648	908,042	20,715	32,184	13,395,066	12,998,174	1,602,440	469,675
Utah	(1)	(1)	(1)	(1)	1,354,613	982,586	977,075	570,822
Vermont	----------	----------	(1)	(1)	219,403	163,251	1,362,211	565,143
Virginia	(1)	(1)	----------	----------	3,599,710	3,782,753	812,873	266,404
Washington	600,583	217,936	181,054	70,267	6,007,098	4,456,197	3,208,816	1,935,215
West Virginia	(1)	(1)	(1)	(1)	3,284,805	5,491,274	(1)	(1)
Wisconsin	748,487	269,230	216,888	109,142	9,389,386	6,806,503	7,634,080	3,650,058
Wyoming	299,103	202,114	11,865	957	604,121	493,713	1,748,372	1,419,125
Undistributed [1]	1,054,007	566,534	442,436	310,007	442,989	448,798	6,192,000	4,247,000
Total	10,444,070	5,618,124	2,393,486	1,716,039	231,205,478	211,336,119	87,899,000	37,107,000

[1] Figures that may not be shown separately are combined as "Undistributed."
[5] Includes 4,406,251 tons of ballast gravel valued at $1,748,602, produced by railroads for their own use.
[6] Includes 759,841 tons of gravel valued at $240,217, used by railroads for fills and similar purposes.

Government-and-Contractor Production.—As shown in the accompanying chart and tables, the output of sand and gravel from noncommercial or Government-and-contractor operations in 1949 accounted for 28 percent of the total tonnage, compared with 27 percent in 1948. The value of this output represented 15 percent of the total

dollar value for the industry. The increase in output may be accounted for largely by the increased utilization of material in paving construction.

States reported 50 percent of the total Government-and-contractor output in 1949, counties 39, Federal agencies 9, and municipalities 2. In 1949 contractors furnished 50 percent of the Government-and-contractor tonnage, as they did in 1948. The average value decreased from 48 to 42 cents per ton in 1949.

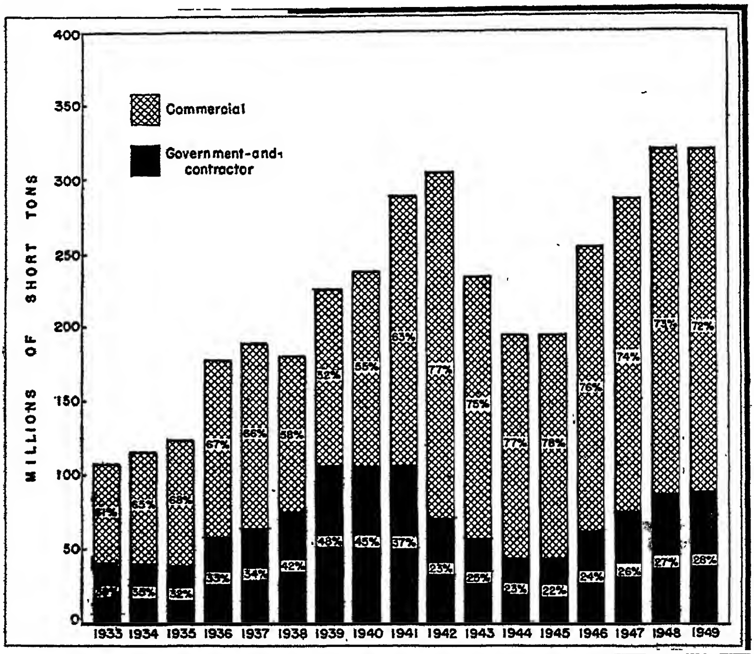

FIGURE 2.—Sand and gravel sold or used in the United States by commercial and Government-and-contractor producers, 1933–49.

Sand and gravel sold or used by Government-and-contractor producers in the United States, 1945–49, by uses

Year	Sand				Gravel				Total Government-and-contractor sand and gravel	
	Building		Paving		Building		Paving			
	Short tons	Value (dollars)	Short tons	Value (dollars)	Short tons	Value (dollars)	Short tons	Value (dollars)	Short tons	Value (dollars)
1945	1,018,000	428,000	5,631,000	1,998,000	2,145,000	1,225,000	34,592,000	14,764,000	43,386,000	18,415,000
1946	894,000	313,000	4,752,000	1,629,000	2,752,000	1,416,000	53,641,000	19,932,000	62,039,000	23,290,000
1947	1,551,000	717,000	6,049,000	2,316,000	2,208,000	1,541,000	65,289,000	29,923,000	75,097,000	34,497,000
1948	1,529,000	811,000	7,336,000	3,452,000	5,487,000	3,405,000	71,411,000	33,510,000	85,763,000	41,178,000
1949	1,604,000	959,000	7,424,000	2,820,000	3,133,000	2,235,000	75,738,000	31,093,000	87,899,000	37,107,000

Sand and gravel sold or used by Government-and-contractor producers in the United States, 1946–49, by type of producer

Type of producer	1946 Short tons	1946 Average value per ton	1947 Short tons	1947 Average value per ton	1948 Short tons	1948 Average value per ton	1949 Short tons	1949 Average value per ton
Construction and maintenance crews	37,614,000	$0.32	38,662,000	$0.35	42,531,000	$0.34	43,586,000	$0.31
Contractors	24,425,000	.46	36,435,000	.58	43,232,000	.62	44,313,000	.53
Total	62,039,000	.38	75,097,000	.46	85,763,000	.48	87,899,000	.42
States	30,812,000	.40	37,017,000	.49	45,166,000	.55	44,354,000	.44
Counties	26,005,000	.31	26,958,000	.34	32,260,000	.32	33,822,000	.31
Municipalities	1,402,000	.41	1,573,000	.46	1,881,000	.41	2,131,000	.40
Federal agencies	3,820,000	.63	9,549,000	.70	6,456,000	.83	7,592,000	.82
Total	62,039,000	.38	75,097,000	.46	85,763,000	.48	87,899,000	.42

DEGREE OF PREPARATION

Whereas Government-and-contractor sand and gravel commonly includes a high proportion of unprepared material, the reverse is true of commercial plants. As preparation adds substantially to production costs, commercial output has a higher average value. The accompanying table shows this relationship in the past 2 years. Prepared sand and gravel (commercial and Government-and-contractor) represented 74 percent of the total production in 1949 compared with 73 percent in 1948. This gain resulted largely from the increase in prepared material by Government-and-contractor operations during 1949.

Sand and gravel (prepared or unprepared) sold or used by producers in the United States, 1948–49, by commercial and Government-and-contractor operations

	1948 Quantity Short tons	1948 Quantity Percent	1948 Average value per ton	1949 Quantity Short tons	1949 Quantity Percent	1949 Average value per ton
Commercial operations:						
Prepared	212,072,878	91	$0.95	210,756,159	91	$0.96
Unprepared	21,430,644	9	.50	20,449,319	9	.47
Total	233,503,522	100	.90	231,205,478	100	.91
Government-and-contractor operations:						
Prepared	20,514,000	24	1.02	24,807,000	28	.91
Unprepared	65,249,000	76	.31	63,092,000	72	.23
Total	85,763,000	100	.48	87,899,000	100	.42
Grand total	319,266,000		.79	319,104,000		.78

SIZE OF PLANTS

The average plant output of commercial operators, except railroad plants, approximated 92,000 short tons in 1949 compared with 96,000 tons in 1948. Plants producing 100,000 to 200,000 tons in 1949 accounted for 21 percent of the total output, the largest quantity produced by any one group. Plants producing more than 500,000 tons annually decreased from 63 to 57 and furnished 23 percent of the production. The less than 25,000 ton group showed the greatest expansion in number of plants—from 916 to 953. Details of output, by size groups, are shown in the accompanying table.

Comparison of number and production of commercial sand and gravel plants in the United States, 1948–49, by size groups [1]

Size group, in short tons	1948				1949			
	Plants [2]		Production		Plants [2]		Production	
	Number	Percent of total	Short tons	Percent of total	Number	Percent of total	Short tons	Percent of total
Less than 25,000	916	38.6	8,975,000	4.0	953	38.8	9,320,000	4.1
25,000 to less than 50,000	395	16.7	14,486,000	6.4	425	17.3	15,344,000	6.8
50,000 to less than 100,000	429	18.1	30,277,000	13.3	449	18.3	32,019,000	14.2
100,000 to less than 200,000	324	13.7	45,203,000	19.9	337	13.7	47,223,000	21.0
200,000 to less than 300,000	148	6.3	36,078,000	15.9	146	5.9	35,576,000	15.8
300,000 to less than 400,000	60	2.5	20,505,000	9.0	53	2.2	18,147,000	8.0
400,000 to less than 500,000	36	1.5	15,909,000	7.0	38	1.5	16,983,000	7.5
500,000 to less than 600,000	20	.8	10,871,000	4.8	16	.7	8,703,000	3.9
600,000 to less than 700,000	11	.5	7,076,000	3.1	6	.2	3,848,000	1.7
700,000 to less than 800,000	3	.1	2,202,000	1.0	11	.4	8,310,000	3.7
800,000 to less than 900,000	8	.3	6,782,000	3.0	7	.3	5,906,000	2.6
900,000 to less than 1,000,000	4	.2	3,826,000	1.7	3	.1	2,881,000	1.3
1,000,000 and over	17	.7	24,756,000	10.9	14	.6	21,204,000	9.4
Total	2,371	100.0	226,946,000	100.0	2,458	100.0	225,464,000	100.0

[1] Excludes operations by or for States, counties, municipalities, and Federal Government agencies as follows—1948: 774 with an output of 85,763,000 tons of sand and gravel; 1949: 807 operations, 87,899,000 tons. Excludes operations by or for railroads as follows—1948: 147 with an output of 6,557,000 tons of sand and gravel; 1949: 128 operations, 5,741,000 tons.

[2] Includes a few companies operating more than 1 plant but not submitting separate returns for individual plants.

METHOD OF TRANSPORTATION

Truck transportation in 1949 moved 41 percent of shipments from commercial plants (69 percent of total commercial and Government-and-contractor output). Railroads carried most of the remainder, but their portion of the total decreased from 25 percent in 1948 to 22 percent in 1949. Shipments by waterway, a method important in a few areas, was maintained at 6 percent, while 3 percent in 1949 was unspecified as to method of transportation. As shown in the accompanying table, the percentage of shipments (commercial and Government-and-contractor) moved by truck and rail accounted for 91 percent of the total tonnage.

Sand and gravel sold or used in the United States, 1947–49, by methods of transportation

	1947		1948		1949	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Commercial:						
Truck	107,381,000	37	125,468,000	39	131,725,000	41
Rail	75,942,000	26	78,888,000	25	70,035,000	22
Waterway	19,003,000	7	18,839,000	6	19,253,000	6
Unspecified	10,236,000	4	10,308,000	3	10,192,000	3
Total commercial	212,562,000	74	233,503,000	73	231,205,000	72
Government-and-contractor: [1]						
Truck	75,097,000	26	85,763,000	27	87,899,000	28
Grand total	287,659,000	100	319,266,000	100	319,104,000	100

[1] Entire output of Government-and-contractor operations assumed to be moved by truck.

CONSUMPTION TRENDS

Sand and Gravel for Construction.—The demand for sand and gravel by the construction industry in 1949, as indicated by shipments from commercial plants, showed a slight over-all increase over the previous year. Building sand remained at about the same level as in 1948, but increases in building gravel and sand and gravel for paving reflected the high rate of construction activity.

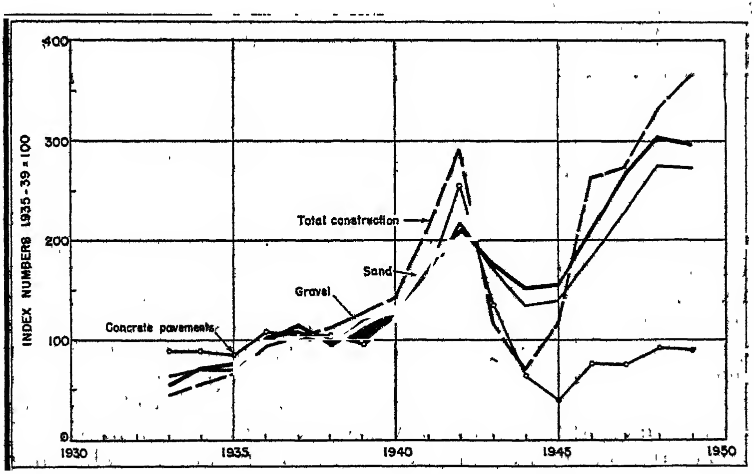

FIGURE 3.—Value of sand and gravel production compared with total construction (contract awards, value) and concrete pavements (contract awards, square yards) in the United States, 1933–49. Data on construction and pavements from Survey of Current Business.

Industrial Sands.—In general, the output of industrial sands declined in 1949. These decreases ranged from 1 percent for fire or furnace sand to 26 percent for molding sand, but the production of filter sand was 20 percent over the 1948 total. Coal strikes in 1949 no doubt hampered production of engine sand. Output of these sands depends on activity in the various consuming industries.

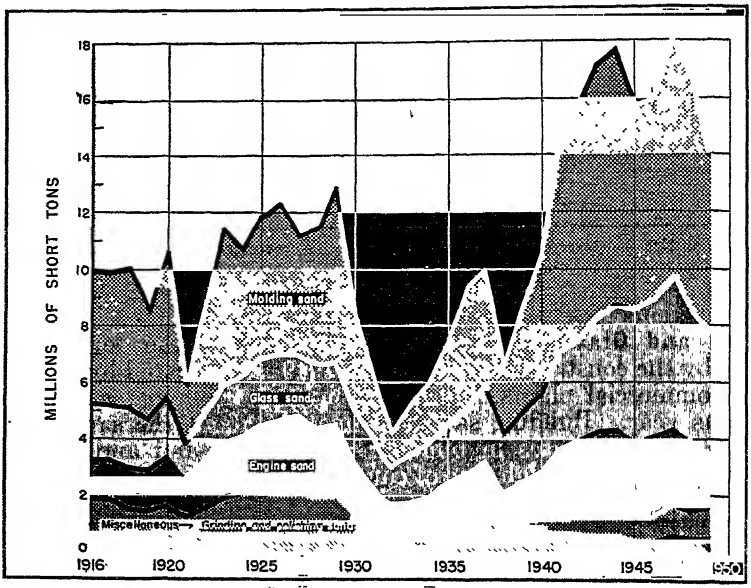

FIGURE 4.—Production of industria lsands in the United States, 1916–49.

EMPLOYMENT AND PRODUCTIVITY

The total number of men employed in the sand and gravel industry in 1949 averaged more than 26,000, slightly higher than in 1948. As indicated in the following table, the average number of days worked decreased from 246 in 1948 to 232 in 1949, while the average production per man per shift increased from 37.2 to 37.4 short tons. The accompanying table, showing a breakdown of employment and production, by regions, of commercial plants (except those operated by railroads), indicates that the California-Nevada region employed the greatest number of men and that the Wyoming-Colorado-New Mexico-Utah-Arizona region employed the smallest number. The highest production per man per hour and shift was reported from the Michigan-Wisconsin region.

Employment in the commercial sand and gravel industry and average output per man in the United States, 1945–49, by regions [1]

	Employment					Production (short tons)			Percent of commercial industry represented
		Time employed					Average per man		
	Average number of men	Average number of days	Total man-shifts	Man-hours: Average per man per day	Man-hours: Total	Commercial sand and gravel	Per shift	Per hour	
1945	16,528	233	3,857,671	8.7	33,745,368	116,632,047	30.2	3.5	76.7
1946	18,400	240	4,408,376	8.8	39,001,584	159,203,204	36.1	4.1	82.9
1947	21,244	246	5,218,164	8.7	45,376,180	179,664,522	34.4	4.0	84.5
1948									
Maine, N. H., Vt., R. I., Mass., and Conn.	819	212	173,454	8.6	1,492,570	7,766,192	44.8	5.2	91.6
N. Y.	1,109	235	260,717	8.4	2,189,002	11,044,255	42.4	5.0	74.4
Pa., N. J., and Del.	2,419	275	664,715	8.4	5,609,262	17,770,242	26.7	3.2	95.8
W. Va., Va., Md., and D. C.	1,747	270	471,289	9.0	4,242,050	10,854,258	23.0	2.6	86.4
S. C., Ga., Ala., Fla., and Miss.	969	268	260,022	9.1	2,360,940	8,128,399	31.3	3.4	94.0
N. C., Ky., and Tenn.	921	264	243,356	9.1	2,209,890	6,437,476	26.5	2.9	86.2
Ark., La., and Tex.	1,591	310	492,655	8.0	3,934,280	14,271,231	29.0	3.6	69.9
Ohio	1,618	259	419,236	8.4	3,512,113	14,526,897	34.7	4.1	96.0
Ill. and Ind.	2,104	244	512,484	8.5	4,354,167	22,799,985	44.5	5.2	89.4
Mich. and Wis.	2,038	206	419,649	9.0	3,760,527	22,666,492	54.0	6.0	90.1
N. Dak., S. Dak., and Minn.	763	176	134,635	9.2	1,239,238	5,239,577	38.9	4.2	62.4
Nebr. and Iowa	659	195	128,296	9.4	1,201,903	6,874,071	53.6	5.7	82.0
Kans., Mo., and Okla.	951	235	223,873	8.6	1,920,846	9,143,233	40.8	4.8	92.2
Wyo., Colo., N. Mex., Utah, and Ariz.	453	208	94,103	8.4	787,080	4,539,368	48.2	5.8	88.2
Calif. and Nev.	2,516	252	635,143	8.2	5,203,952	26,950,548	42.4	5.2	90.4
Mont., Wash., Oreg., and Idaho	1,218	210	255,540	8.2	2,085,525	11,694,539	45.8	5.6	77.4
Total	21,895	246	5,389,167	8.6	46,103,345	200,706,763	37.2	4.4	86.0
1949									
Maine, N. H., Vt., R. I., Mass., and Conn.	911	208	189,549	8.5	1,616,792	7,693,475	40.6	4.8	93.3
N. Y.	1,209	251	303,062	8.3	2,526,065	12,007,995	39.6	4.8	74.7
Pa., N. J., and Del.	2,346	255	598,433	8.5	5,069,300	16,825,512	28.1	3.3	98.0
W. Va., Va., Md., and D. C.	1,723	243	418,457	9.0	3,776,867	9,821,968	23.5	2.6	84.2
S. C., Ga., Ala., Fla., and Miss.	963	269	258,922	9.0	2,336,588	7,641,772	29.5	3.3	96.4
N. C., Ky., and Tenn.	1,008	264	265,967	9.0	2,398,965	6,680,971	25.1	2.8	91.6
Ark., La., and Tex.	2,002	270	540,929	9.2	4,956,555	17,672,697	32.7	3.6	84.3
Ohio	1,632	248	404,908	8.5	3,422,198	12,321,225	30.4	3.6	85.1
Ill. and Ind.	1,976	237	467,612	8.4	3,951,075	21,861,734	46.8	5.5	88.3
Mich. and Wis.	2,242	174	389,692	9.1	3,539,429	20,789,113	53.3	5.9	83.6
N. Dak., S. Dak., and Minn.	725	151	109,609	9.0	991,638	5,425,754	49.5	5.5	62.2
Nebr. and Iowa	670	232	155,139	9.4	1,457,397	7,206,448	46.5	4.9	79.9
Kans., Mo., and Okla.	1,155	226	260,650	8.5	2,219,449	9,945,635	38.2	4.5	89.6
Wyo., Colo., N. Mex., Utah, and Ariz.	463	208	96,425	8.2	795,076	4,317,922	44.8	5.4	88.3
Calif. and Nev.	2,417	243	586,278	8.3	4,841,409	27,411,956	46.8	5.7	92.7
Mont., Wash., Oreg., and Idaho	1,522	191	291,079	8.2	2,387,236	12,031,532	41.3	5.0	83.3
Total	22,964	232	5,336,711	8.7	46,286,039	199,655,709	37.4	4.3	86.4

[1] Excludes plants operated by or directly for States, counties, municipalities, and Federal Government agencies.

PRICES

The average value for all shipments of sand and gravel in 1949 decreased 1 percent below the 1948 figures. While the average value for commercial plants increased only 1 percent in 1949, the value for

Government-and-contractor operations decreased 13 percent. Prices for commercial paving and building sand and gravel showed little fluctuation from 1948 levels; the greatest increase in these items was 3 cents for paving gravel. Changes in prices for the industrial sands ranged from an increase of 11 cents for glass sand to a decrease of 43 cents for filter sand; sand for railroad ballast, however, remained at 43 cents per ton. Gravel for railroad ballast and "other" uses decreased 2 and 10 cents, respectively, from 1948 figures. In the Government-and-contractor output sand and gravel for paving decreased in average value, whereas building sand and gravel registered substantial gains.

FOREIGN TRADE[1]

Imports of sand and gravel in 1949 declined to 434,170 short tons valued at $322,412, a decrease of 2 percent in quantity and 10 percent in value from the 1948 figures. Belgium furnished virtually all of the glass sand, while Canada supplied 285,688 short tons of "other sand," with Iceland, United Kingdom, and France supplying the balance. The gravel imported amounted to 135,227 short tons and came from Canada.

Sand and gravel imported for consumption in the United States, 1940–49, by classes

[U. S. Department of Commerce]

Year	Sand				Gravel		Total	
	Glass sand [1]		Other sand [2]					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1940	4,337	$8,722	264,170	$90,350	175,558	$25,686	444,065	$124,758
1941			263,389	105,088	164,175	26,132	427,564	131,220
1942	(3)	5	408,825	297,122	146,116	60,389	554,941	357,516
1943	18	363	296,262	206,145	86,924	63,381	383,204	269,889
1944	15	181	209,255	129,632	67,929	31,208	277,199	161,021
1945	(3)	148	200,280	126,102	80,861	43,976	281,141	170,226
1946	5,006	9,102	[4] 262,484	[4] 194,820	83,860	25,847	[4] 351,350	[4] 229,769
1947	7,804	12,532	297,481	283,884	177,244	100,665	482,529	397,081
1948	16,914	24,134	[4] 336,898	[4] 302,117	89,174	30,411	[4] 442,986	[4] 356,662
1949	11,491	20,152	287,452	283,066	135,227	19,194	434,170	322,412

[1] Classification reads: "Sand containing 95 percent or more silica and not more than 0.6 percent oxide of iron and suitable for manufacture of glass."
[2] Classification reads: 1940–47: "Sand, n. s. p. f."; 1948–49: "Sand, n. s. p. f., crude or manufactured."
[3] Less than 1 ton.
[4] Revised figure.

TECHNOLOGY

According to a recent announcement two plants are currently using a hydraulic classifier for washing silica sand for the glass and chemical markets. For these industrial uses the absence of clay is imperative, and the iron content must be held at a minimum. The plant equipment consists essentially of a high water column, baffle plates, and separate intercommunicating chambers for particle settling. Details are presented in the report.[2]

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.
[2] Morris, A. B., Hydraulic Sand Classifier: Rock Products, vol. 52, No. 6, June 1949, pp. 109–113.

The possibility of utilizing the sink-float process in the sand and gravel industry was mentioned in the 1948 chapter. A description of the heavy-media separation for sand and gravel has been reported in the literature. This method was used to remove shale, limonite, chert, fossil corals, and hematite concretions from gravel.[3]

Two patents covering the testing of molding or foundry sands have been issued. United States Patent 2,466,453 describes an electrical instrument for determining the moisture content of foundry sands, while patent 2,448,964 describes an apparatus that measures the expansion characteristics of compacted molding sands at elevated temperatures.[4]

A technique of attrition that makes possible the production of high-quality sand for flint glass from a low-grade sandstone is described in a recent report.[5]

The scarcity of natural sand for construction purposes sometimes necessitates the manufacture of sand from massive rock. Granite, limestone, chert, and sandstone have been utilized as source material for the manufacture of sand.[6]

Committee C–9 on concrete and concrete aggregates of the American Society for Testing Materials, at the annual meeting in Atlantic City, N. J., adopted a proposed tentative method of test for soft particles in coarse aggregates (A. S. T. M. Designation: C — –49 T). This method of test covers the procedure for determining the quantity of soft particles in coarse aggregates on the basis of scratch hardness. The apparatus used is a brass rod about 1/16-inch in diameter and having a Rockwell hardness of B65 to B75. Details of sample size and procedure are given in the report of Committee C–9.

The passage of antistream pollution legislation in some States has given rise to the thought of impounding the tailings or finer rejects from aggregate plants. Several methods for building tailing ponds have been described.[7]

In connection with the improvement of the flow sheet of a sand and gravel plant, one operator in Pennsylvania installed a jaw crusher to process oversize rock that formerly had been rejected. The crusher was reported to incorporate a "crushing without rubbing" method.[8]

The problem of elongated particles in aggregate is one that has plagued operators for many years. An article describing a method of eliminating slivery particles at a combination crushed stone and sand and gravel plant has been reviewed.[9]

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[3] Pit and Quarry, vol. 42, No. 6, December 1949, pp. 60–63.
[4] Journal American Ceramic Society, vol. 32, No. 10, Oct. 1, 1949, p. 239; vol. 32, No. 4, Apr. 1, 1949. p. 113.
[5] Journal American Ceramic Society, vol. 32, No. 8, Aug. 1, 1949, p. 191.
[6] Rock Products, vol. 52, No. 7, July 1949, pp. 56–59, 84–85; vol. 52, No. 9, September 1949, pp. 58–62.
Pit and Quarry, vol. 42, No. 3, September 1949, pp. 74–78.
Roads and Streets, vol. 92, No. 8, August 1949, pp. 55–58, 60–64.
Rock Products, vol. 52, No. 9, September 1949, p. 65.
[7] Rock Products, vol. 52, No. 12, December 1949, pp. 99–101, 130–131.
[8] Pit and Quarry, vol. 41, No. 12, June 1949, pp. 94–95.
[9] Rock Products, vol. 52, No. 12, December 1949, pp. 119–122.

Secondary Metals—Nonferrous

By Archie J. McDermid [1]

GENERAL SUMMARY

THE GENERAL decline in industrial activity that occurred in the first half of 1949 caused sharp decreases in the consumption of nonferrous scrap metals. As a result, the outputs of secondary metal in 1949 were considerably below corresponding totals for 1948, although an upswing in later months of the year limited the loss. Another factor in declining demand for scrap metals was the replenishment of industrial inventories and working stocks and of the consumer goods made from them, which had been slow in rebuilding after depletion during World War II. Consumers of metals, both primary and secondary, finding that scarcity no longer existed and anticipating declines in market prices, adopted a policy of cautious buying. Users drew on raw material in inventory, buying only when stocks dropped below a minimum working level.

Salient statistics of nonferrous secondary metals recovered in the United States, 1948–49

Metal	From new scrap		From old scrap		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1948						
Aluminum	191,129	$55,427,410	95,648	$27,737,920	286,777	$83,165,330
Antimony	3,594	2,635,840	17,998	13,199,733	21,592	15,835,573
Copper	467,324	202,818,616	505,464	219,371,376	972,788	422,189,992
Lead	67,338	24,107,004	432,733	154,918,414	500,071	179,025,418
Magnesium [1]	3,365	1,379,650	4,188	1,717,080	7,553	3,096,730
Nickel	5,944	4,679,117	2,906	2,287,603	8,850	6,966,720
Tin	10,034	19,917,490	20,090	39,878,650	30,124	59,796,140
Zinc	250,449	66,619,434	74,190	19,734,540	324,639	86,353,974
Total		377,584,561		478,845,316		856,429,877
1949						
Aluminum	136,166	42,946,756	44,596	14,065,579	180,762	57,012,335
Antimony	3,085	2,389,641	14,976	11,600,410	18,061	13,990,051
Copper	329,595	129,860,430	383,548	151,117,912	713,143	280,978,342
Lead	48,043	15,181,588	364,140	115,068,240	412,183	130,249,828
Magnesium	3,023	1,239,430	2,939	1,204,990	5,962	2,444,420
Nickel	3,766	3,234,241	1,914	1,648,743	5,680	4,877,984
Tin	8,378	16,641,389	16,523	32,819,965	24,901	49,461,354
Zinc	186,162	46,168,176	51,651	12,809,448	237,813	58,977,624
Total		257,661,651		340,330,287		597,991,938

[1] Revised figures.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the Department of Commerce.

Under such conditions prices weakened, first scrap prices and then those of refined metal. Refiners were paying as high as 22 cents a pound for No. 1 copper scrap early in December 1948 but by the end of the month were purchasing it for 20.5 cents and by June 1949 for 12.5 cents. The price of refined copper remained at 23.5 cents a pound from August 1948 until March 1949 and then descended progressively to 16 cents in June. Similar trends were noted in the prices of scrap and refined lead and zinc. The market for aluminum scrap declined in the same period, but primary aluminum ingot prices remained at 17 cents a pound throughout 1949. Scrap-metal prices in general improved in the latter part of 1949 but did not reach the 1948 levels.

Consumption of lead scrap was affected not only by the business recession but by increased importation of lead from countries that devalued their currencies. Use of aluminum scrap and secondary ingot was also adversely affected by imports and by increased availability of primary aluminum. Although demand for nonferrous scrap metals was smaller in 1949 than in 1948, supplies of copper and aluminum scrap were scarce, chiefly because of the depleted sources of military scrap.

The value of metals recovered in 1949 from both old and new scrap was $597,991,938 compared with $856,429,877 (revised figure) in 1948. The decrease was attributable to smaller quantities recovered and in most instances to lower prices. The value of metals recovered from old scrap, after increasing for 6 years, declined from $478,845,316 (revised figure) in 1948 to $340,330,287 in 1949.

The figures for the values of secondary metals recovered are calculated on the basis of replacement of primary metals by secondary; that is, it is assumed that if the plants involved had not been able to use scrap in their operations they would have had to use primary metals worth the figures quoted above. The amounts are useful for year-to-year comparisons, but they do not represent actual receipts by the secondary plants for their products. As a matter of fact, the unit prices of secondary metals are usually somewhat less than those of primary metals of the same purity and composition. Secondary smelters operate through their ability to remelt scrap items of different compositions in the proper proportions to form ingot of specified grade at such a price that foundries will buy it instead of producing their own alloys from primary metals or scrap.

The War Assets Administration, which was created on March 25, 1946, by Executive Order under the Surplus Property Act of 1944, was abolished on July 1, 1949. Virtually all of the 27.2 billion dollars worth of property, including large quantities of scrap metals, that had been declared surplus to WAA had been disposed of. Surplus items remaining were assigned to the Liquidation Service of the General Services Administration for disposal.

Secondary metals recovered as unalloyed metal, in alloys, and in chemical compounds in the United States, 1945–49, in short tons

Metal	1945	1946	1947	1948	1949
Aluminum	298,387	278,073	344,837	286,777	180,762
Antimony	17,148	19,115	22,984	21,592	18,061
Copper	1,006,516	803,546	961,741	972,788	713,143
Lead	363,039	392,787	511,970	500,071	412,183
Magnesium	9,247	5,117	9,503	7,553	5,962
Nickel	6,483	8,248	9,541	8,850	5,680
Tin	35,133	27,671	30,054	30,124	24,901
Zinc	360,444	300,682	310,793	324,639	237,813

SCOPE OF REPORT

Plants canvassed in nonferrous secondary metal surveys include all known consumers of purchased nonferrous scrap metals, as well as consumers of refined copper and brass ingot. The accompanying table classifies the plants canvassed by type of operation and kind of material consumed. Secondary smelters have been recorded in more than one column if they used more than one kind of material; otherwise, there is no duplication. The tabulation of the number of plants in some categories is subject to limitations. The large number of foundries and the small size of many of them makes it impossible to obtain reports from all units. On the other hand, a few large corporations operating more than one plant prefer to file consolidated reports, in which the number and location of plants are not given, with the result that only one plant is credited. These limitations, however, do not affect seriously the validity of the data presented.

The statements from industry, on which data in this chapter are based, were received monthly from the larger smelters, chemical plants, and manufacturers and from brass and wire mills. Foundries, primary aluminum producers, and smaller plants of other types were canvassed on an annual basis.

Number and classification of plants consuming nonferrous scrap metals, refined copper, and copper alloy ingots in 1949

Kind of plant	Type of materials used				
	Aluminum	Copper	Lead and tin	Zinc	All nonferrous types
Primary producers	[1] 32	16	8		
Secondary smelters	[2] 60	[3] 100	259	131	
Distillers				[4] 25	
Chemical plants	16	52		24	
Brass mills		52			
Wire mills		[5] 14			
Foundries and miscellaneous manufacturers			30	[6] 14	[7] 2,750

[1] Includes aluminum reduction plants and rolling mills.
[2] Includes 57 aluminum-alloy ingot makers and 3 naval air stations.
[3] Includes 70 secondary copper smelters and 30 smelters using copper scrap in other than copper alloys.
[4] Includes 17 secondary plants, including zinc-dust plants, and 7 primary producers which used scrap in addition to ore.
[5] Refers to companies operating wire mills. Some companies operate more than 1 plant.
[6] Includes galvanizers, die casters, and zinc rolling mills.
[7] Chiefly brass foundries, but some aluminum foundries, iron foundries, steel plants, and miscellaneous manufacturers. Any or all types of nonferrous scrap were used by these consumers. Excludes plants not established in Bureau of Mines surveys.

Definitions of terms used in this chapter are as follows:

"Secondary metals" are metals or alloys recovered from scrap and residues. The term "secondary" applies only to the source of the metal and has no relation to the type of product recovered, either as to quality, degree of purity, or physical characteristics.

Scrap metals are divided into three main categories: Old scrap, process or plant scrap, and defective finished or semifinished articles returned by purchasers to be reworked.

"Old" scrap is defined as consisting of metal articles that have been discarded because of wear, damage, or obsolescence, usually after serving a useful purpose. Typical examples of old scrap are discarded trolley wire, battery plates, railroad-car boxes, fired cartridge cases, automobile crank cases, used pipe, lithographers' plates, and obsolete military equipment (frequently unused).

"Process" scrap is that generated during the manufacture of articles for ultimate consumption. Typical examples of process scrap are clippings, turnings, borings, skimmings, slags, and drosses.

"Process" scrap is divided into two classifications: "Home" scrap, consumed in the plant of generation, and "new" scrap, which is consumed elsewhere, either after sale to another company or shipment to another plant of the same company. Defective articles, the third main class of scrap, are classed as new scrap for tabulation purposes. In this chapter consumption of old and new scrap only is tabulated, no record being kept, in nonferrous metal canvasses, of home scrap. Consumption of scrap is always measured at the point where it loses its identity as scrap and becomes secondary metal.

Borings and turnings and other items of process scrap when consumed outside the plant of generation are new scrap, whether clean, rusty, or oily and whether generated recently or long before reclamation. Residues are new scrap if generated in processing scrap or refined metal. For example, flue dust from smelting brass scrap is new scrap. Zinc chemical residues resulting from the consumption of zinc dust in the manufacture of sodium hydrosulfite are also new scrap. Residues generated in processing ore or concentrates are not scrap but primary residue. Old mine tailings are primary residue because generated in processing ore.

COMPARISON WITH PRIMARY METALS

Secondary and primary nonferrous metal operations in the United States, the United Kingdom, and western Germany are compared in the following tables. About 80 percent of the refined copper and lead and about 92 percent of the slab zinc shown as consumed in the United States table were of primary origin. The sequence of copper percentages in the British table shows that scrap as compared to refined copper was more important in war years than later, whereas the copper percentages in the United States table show no definite trend. The importance of secondary lead in relation to primary metal increased in both the United States and the British Isles in the period covered by the tables. The proportion of secondary metal in the slab zinc consumed in the United Kingdom is probably higher than in the United States, but assuming that all the slab zinc con-

Comparison of secondary nonferrous metal production and consumption with total refined metal consumption in the United States, 1941–49, in short tons

	1941	1942	1943	1944	1945	1946	1947	1948	1949
ALUMINUM									
roduction:									
Total secondary aluminum	106,857	196,464	313,961	325,645	298,387	278,073	344,837	286,777	180,762
Secondary aluminum from old scrap	43,113	41,633	33,094	22,899	27,311	90,535	163,847	95,648	44,596
onsumption:									
Primary aluminum	302,788	588,969	877,349	671,072	696,750	575,687	571,789	684,575	635,956
Aluminum-base scrap (recoverable aluminum content)	106,775	195,657	312,479	324,589	297,522	277,177	343,892	285,837	179,819
Ratio of aluminum-base scrap to primary aluminum (percent)	35	33	36	48	43	48	60	42	28
COPPER									
roduction:									
Total secondary copper	726,396	927,755	1,086,047	950,942	1,006,516	803,546	961,741	972,788	713,143
Secondary copper from old scrap	412,699	427,122	427,521	456,710	497,095	406,453	503,376	505,464	383,548
onsumption:									
Refined copper [1]	1,641,550	1,608,000	1,502,000	1,504,000	1,379,272	1,187,009	1,463,294	1,420,584	1,183,196
Copper-base scrap (recoverable copper content)	720,094	916,833	1,068,887	934,182	990,571	790,082	945,689	959,764	705,157
Ratio of copper-base scrap to refined copper (percent)	44	57	71	62	72	67	65	68	60
LEAD									
roduction:									
Total secondary lead	397,416	323,001	342,094	331,416	363,039	392,787	511,970	500,071	412,183
Secondary lead from old scrap	380,280	308,588	310,703	289,933	309,849	344,543	444,578	432,733	364,140
onsumption:									
Refined lead	812,647	607,111	675,465	722,820	637,499	530,588	660,657	680,516	592,682
Lead-base scrap (recoverable lead content)	369,950	299,893	316,570	310,378	338,385	368,069	485,340	471,830	392,309
Ratio of lead-base scrap to refined lead (percent)	46	49	47	43	53	69	73	69	66
ZINC									
roduction:									
Total secondary zinc	283,967	330,526	368,488	345,469	360,444	300,682	310,793	324,639	237,813
Secondary zinc from old scrap	81,154	72,987	84,225	113,161	91,266	77,223	74,979	74,190	51,651
onsumption:									
Slab zinc	827,435	728,169	816,777	888,626	852,311	801,242	786,360	817,735	711,841
Zinc-base scrap (recoverable zinc content)	155,844	124,496	124,433	132,522	139,435	142,935	163,354	165,872	137,971
Ratio of zinc-base scrap to slab zinc (percent)	19	17	15	15	16	18	21	20	19

[1] Apparent consumption of new copper, 1941–44; reported consumption of refined copper, 1945–49.

Comparison of nonferrous scrap and refined metal consumption in the United Kingdom,[1] 1942–49, in short tons

	1942	1943	1944	1945	1946	1947	1948	1949
COPPER								
Virgin copper	549,669	502,468	389,921	323,245	364,452	392,139	399,612	356,980
Secondary copper and copper in scrap	368,847	388,349	307,884	193,670	188,509	213,656	203,683	199,342
Ratio of scrap to virgin copper (percent)	67	77	79	60	52	54	51	56
LEAD								
Imported virgin lead [2]	257,000	220,698	230,039	250,428	216,733	199,181	210,497	175,836
English refined [3]	17,620	17,633	17,727	14,179	28,668	33,130	38,223	45,320
Total refined	274,620	238,331	247,766	264,607	245,401	232,311	248,720	221,156
Scrap including remelted	82,374	80,022	68,772	64,794	109,859	123,084	132,787	146,805
Ratio of scrap to refined lead (percent)	30	34	28	24	45	53	53	66
ZINC								
Slab zinc	289,592	249,514	206,344	194,127	242,028	249,997	250,024	222,540
Remelted scrap and residues (zinc content)	154,009	171,427	139,642	86,312	82,065	104,362	97,722	97,910
Ratio of scrap to slab zinc (percent)	53	69	68	44	34	42	39	44

[1] British Bureau of Nonferrous Metal Statistics, vol. 3, No. 3, March 1950, pp. 20, 45, 65.
[2] Includes pig lead refined from imported bullion.
[3] Lead reclaimed from secondary and scrap material and lead refined from domestic ores.

sumed in the United Kingdom was of primary origin a comparison of the zinc percentages indicates that zinc scrap was more important in relation to primary metal than in the United States.

The information about the German Republic was obtained through conversations with American officials who had been there recently or who had received reports on conditions in German nonferrous metal industry. The relatively high secondary production in Germany resulted from the abundance of demolition and battle scrap.

Comparison of secondary with total production and consumption of nonferrous metals in Federal Republic of Germany, 1949, in short tons

	Aluminum	Copper	Lead	Zinc
Production:				
From ores	31,000	31,000	53,000	98,000
From scrap	57,000	159,000	60,000	29,000
Total	88,000	190,000	113,000	127,000
Imports		22,000		
Exports			62,000	
Consumption	97,000	203,000	53,000	133,000

SECONDARY ALUMINUM

The recovery of secondary aluminum from scrap totaled 180,762 short tons, valued at $57,012,335, a decrease of 37 percent in quantity from the 286,777 tons, valued at $83,165,330, reclaimed in 1948. Values were calculated on the basis of the average price received by producers of primary pig, which was 14.50 cents a pound in 1948 and 15.77 cents in 1949.

Secondary aluminum [1] recovered in the United States, 1948–49, in short tons

Secondary aluminum recovered			Recoverable aluminum-alloy content of scrap		
Form of recovery	1948	1949	Kind of scrap processed	1948	1949
As metal	2,384	343	New scrap:		
Aluminum alloys	282,302	178,502	Aluminum-base [2]	190,736	135,789
In brass and bronze	455	450	Copper-base	99	82
In zinc-base alloys	776	600	Zinc-base	95	99
In magnesium alloys	354	426	Magnesium-base	199	196
In chemical compounds	506	441	Total	191,129	136,166
Grand total	286,777	180,762	Old scrap:		
			Aluminum-base [3]	95,101	44,030
			Copper-base	93	134
			Zinc-base	292	309
			Magnesium-base	162	123
			Total	95,648	44,596
			Grand total	286,777	180,762

[1] In accordance with common usage, the term "aluminum" covers aluminum alloys, and the figures include all constituents of the alloys recovered from aluminum-base scrap.
[2] Recoverable aluminum content of new aluminum-base scrap was 179,516 tons in 1948 and 128,012 tons in 1949.
[3] Recoverable aluminum content of old aluminum-base scrap was 86,028 tons in 1948 and 41,194 tons in 1949.

Of the recoverable aluminum content of nonferrous scrap consumed in 1949, 99 percent was contained in aluminum scrap, and 99 percent of the total secondary aluminum recovered was reclaimed in aluminum-base products. In other words, most aluminum-bearing scrap was used in aluminum products. The proportions were about the same in other years. Recovery from old scrap decreased from 48 percent of the total secondary recovery in 1947 to 33 percent in 1948 and 25 percent in 1949, chiefly because of decreasing supplies of aircraft scrap.

Production of all types of aluminum-alloy ingot except aluminum-copper- and aluminum-silicon-nickel alloys, decreased in 1949, but output of "Other aluminum-copper" ingot declined much more (89 percent) than that of any other important classification. Production from aircraft scrap, when melted separately, is usually assigned to this type of ingot. It is suitable for deoxidizing some kinds of steel and when made for that purpose may be classed as deoxidizing ingot. Ingot made from aircraft scrap, to which a little pure aluminum may have to be added, can be used for wrought products such as aluminum roofing and siding, but most of the alloy ingot made at secondary plants is used for castings. Total production of alloy ingot, secondary output at primary plants, and recovery of aluminum from scrap in aluminum castings decreased 38, 33, and 27 percent, respectively.

Production of secondary aluminum and aluminum-alloy products in the United States, 1947–49, gross weight in short tons

Product	1947	1948	1949
Secondary aluminum ingot: [1]			
Pure aluminum (98.5 percent)	5,052	2,328	326
Silicon (max. Cu, 1 percent)	12,370	11,786	7,376
Silicon (Cu, 1 to 2.5 percent)	5,108	4,694	3,532
No. 12 aluminum	27,605	19,509	10,605
Other aluminum-copper (max. Si, 2.5 percent) alloys	89,642	[2] 17,612	[3] 1,955
Copper-silicon (each over 2.5 percent) alloys	72,286	80,940	52,900
Aluminum-copper- or aluminum-silicon-nickel alloys	2,101	3,791	5,152
Deoxidizing and other destructive uses	28,965	34,143	23,828
Aluminum hardeners	2,695	3,989	2,209
Al-Mg and Al-Zn alloys	3,833	2,860	2,731
Miscellaneous	10,258	8,387	6,892
Total	259,915	190,039	117,506
Secondary aluminum at primary plants [4]	84,074	93,159	61,990
Aluminum powder [5]	53	56	17
Aluminum-alloy castings	7,645	5,289	3,872
Aluminum in chemicals	379	506	441

[1] Gross weight of alloys, including copper, silicon, and other added elements; total secondary ingot contained 1,525 tons of primary aluminum in 1947, 3,033 tons in 1948, and 2,206 tons in 1949.
[2] Includes 13,776 tons produced at naval air stations and plants of contractors melting down army planes.
[3] Includes 1,785 tons produced at naval air stations.
[4] Combined with primary aluminum for the production of wrought products and castings.
[5] Does not include production measured as ingot for graining, powder, atomizing, or chemical purposes.

There was a growing use of both aluminum and zinc in die castings, especially in the automotive industry. The aluminum die casting plant completed by the Ford Motor Co. in 1949 was reported to be the largest and most modern of its kind. A large increase in the use of aluminum die castings in 1951 Ford car models was expected.[1] This would not decrease the use of zinc die castings because virtually all of these castings were to be used in the new automatic transmission where use of zinc was never contemplated. Another automobile manufacturer is said to have helped develop a process for chrome plating aluminum which will increase the use of aluminum die castings. Several new types of zinc die castings were being used in convertible automobile models. A number of types of aluminum alloy ingot which can be made from scrap, are used for aluminum die castings but very little zinc scrap is used—only 658 tons in 1949—in zinc die castings. The chief ingredient of the latter is special high-grade slab zinc, of which 195,691 tons were used in this product in 1949.

Consumption of aluminum scrap in 1949 was 125,456 tons less than in 1948. The decrease can be attributed to increased availability of primary aluminum, to the business recession, and to imports of secondary ingot from abroad. Primary ingot was more plentiful in 1949 than it had been for a number of years. As primary production remained at virtually the same high level as in 1948 and demand was weaker, plants that had been using secondary ingot or scrap could turn to primary if they so desired. Imports of aluminum scrap were reported as 40,120 tons, much of it remelted into ingot for convenience in shipping. This remelt ingot when used in this country was not generally recorded as scrap consumed, and it reduced the demand for scrap because it was used in place of scrap that might have been consumed. Aluminum scrap consumption declined 39 percent; usage of primary aluminum declined 7 percent.

[1] Modern Metals: Vol. 6, No. 1, February 1950, pp. 10, 12.

Consumption of old and new aluminum scrap in the United States in 1949, gross weight in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries				Total scrap used
			Aluminum rolling mills and reduction plants		Foundries and other manufacturers		
	New scrap	Old scrap	New scrap	Old scrap	New scrap	Old scrap	
Pure clippings, wire, and foil	9,618	273	15,057	61	241	17	25,267
Castings and forgings	14,310	12,027	3,646	2,310	499	1,109	33,901
Alloy sheet	21,027	2,511	32,561	890	1	60	57,050
Scrap sheet and sheet utensil		5,900	4,472	2,608	1,583	801	15,364
Borings and turnings	27,532		2,418		213		30,163
Aircraft scrap		10,188		1,513			11,701
Miscellaneous aluminum and dross	12,798	12,288		66	441		25,593
Total	85,285	43,187	58,154	7,448	2,978	1,987	199,039

Treatment of all classes of aluminum scrap decreased except that of scrap sheet and utensil, which almost doubled. All groups used more of this material, but the primary plants consumed 7,080 tons in 1949 as compared with 376 tons in 1948. Use of aircraft scrap declined sharply (79 percent), and that of alloy sheet, the largest item in both years, decreased 39 percent. The smallest decrease was 4 percent in consumption of borings and turnings. Secondary smelters and naval air stations consumed two-thirds of the total aluminum scrap processed in both 1948 and 1949. The rolling mills and reduction plants used about a third of the total in each year. Foundries and manufacturers of such products as drain cleaners, hair-wave pads, and chemicals used about 2 percent of the total in each year.

Consumers' stocks of aluminum-base scrap in the United States at end of year, 1948–49, gross weight in short tons

Scrap item	Dec. 31, 1948	Dec. 31, 1949
Castings and forgings	5,351	2,792
Sheet, turnings, clippings, etc	16,428	12,917
Aircraft scrap	2,716	2,212
Miscellaneous aluminum and dross	4,203	2,244
Total	28,698	20,165

Dealers' buying prices for cast aluminum scrap were highest in January, when they averaged 12.63 cents a pound. The lowest average was 5.75 cents in July at the end of a 7-month decline. For the final 2 months of the year the average price was 7.75 cents and for the year 7.76 cents. Prices for new aluminum clippings were 16.13 cents in January, dropped to 9.75 cents in July, and stood at 10.75 cents at the end of the year; the average for the year was 11.40 cents. The price of primary aluminum pig was 16 cents a pound throughout 1949.

Imports of aluminum scrap in 1949 were 40,120 tons compared with 71,732 tons (revised figure) in 1948. Exports were 397 tons in 1949 and 438 tons in 1948.

SECONDARY ANTIMONY

Antimony recovered in 1949 from lead- and tin-base scrap totaled 18,061 short tons valued at $13,990,051, a 16-percent decrease in quantity from the 21,592 tons valued at $15,835,573 reclaimed in 1948. The value was computed at 36.67 cents a pound in 1948 and 38.73 cents in 1949, the average New York selling price for primary antimony.

Of the total secondary antimony recovered, 16,286 tons were reclaimed at secondary copper and lead smelters and 1,775 tons at primary lead refineries. New supply of primary antimony from domestic and foreign sources available for consumption in 1949, in terms of recoverable metal, was 11,947 tons.

Secondary antimony recovered in the United States, 1948–49, in short tons

Secondary antimony recovered			Recoverable antimony content of scrap		
Form of recovery	1948	1949	Kind of scrap processed	1948	1949
In antimonial lead	14,163	11,566	New scrap:		
In other lead alloys	7,225	6,311	Lead-base	3,594	3,085
In tin-base alloys	204	184	Tin-base	----------	----------
Grand total	21,592	18,061	Total	3,594	3,085
			Old scrap:		
			Lead-base	17,816	14,809
			Tin-base	182	167
			Total	17,998	14,976
			Grand total	21,592	18,061

Old battery plates yielded 55 percent of all secondary antimony recovered in 1949. However, consumption of battery plates decreased 18 percent from the quantity used in 1948 and was 23 percent under the peak year of 1947. Secondary antimony recovered in antimonial lead, in other lead-base alloys, and in tin-base alloys also decreased. Remelters, smelters, and refiners recovered 94 percent of the secondary antimony reclaimed and manufacturers and foundries the remaining 6 percent. Data on consumption of purchased scrap from which antimony was recovered may be found in the tables on consumption of lead- and tin-base scrap in the sections of this chapter devoted to those metals. Products in which antimony was recovered are included in the lead- and tin-products tables.

All secondary antimony was reclaimed in lead and tin alloys, none being recovered as unalloyed metal; whereas 61 percent of the primary antimony used, exclusive of 1,610 tons of primary antimony recovered from lead-silver ores at primary lead smelters, emerged in metal products, chiefly lead and tin. About 100,000 tons of antimonial lead scrap were softened to produce refined lead, the resulting antimonial lead dross byproduct being used in other metallic products.

Control of receipts and inventories of antimony under General Preference Order M–112, was revoked on March 31. End-use restrictions had been lifted, and new supplies together with declining consumption made further control unnecessary.

Quotations for domestic antimony metal changed only once in 1949. On January 1 the price was 38.50 cents per pound f. o. b. New York; on October 6 it dropped to 32 cents and remained there the balance of the year.

SECONDARY COPPER AND BRASS

The recovery of secondary copper from all classes of nonferrous scrap totaled 713,143 short tons, valued at $280,978,342, in 1949—a decrease of 27 percent in quantity from the 972,788 tons, valued at $422,189,992, recovered in 1948. Value was computed at 21.7 cents a pound in 1948 and 19.7 cents in 1949, the yearly average weighted prices of all grades of refined copper sold by producers in the 2 years.

Rates of operations at plants engaged in the output of secondary copper products changed continually during 1949, decreasing during the first 7 months and increasing in the last 5. Total production from scrap for all sizes and types of plants, from primary refiners to foundries, was substantially less in 1949 than in 1948, but at the end of the year the general trend of activity was strongly upward.

Secondary copper recovered in the United States, 1948–49, in short tons

Secondary copper recovered		
Form of recovery	1948	1949
As unalloyed copper:		
At primary plants	245,376	212,392
At other plants	38,650	37,697
Total	284,026	250,089
In brass and bronze	653,281	436,457
In alloy iron and steel	2,911	1,552
In aluminum alloys	14,678	9,951
In other alloys	280	254
In chemical compounds	17,612	14,840
Total	688,762	463,054
Grand total	972,788	713,143

Recoverable copper content of scrap		
Kind of scrap processed	1948	1949
New scrap:		
Copper-base	458,892	323,666
Aluminum-base	7,231	5,293
Nickel-base	1,192	633
Lead-base	7	
Zinc-base	2	3
Total	467,324	329,595
Old scrap:		
Copper-base	500,872	381,491
Aluminum-base	3,831	1,450
Nickel-base	569	436
Lead-base	87	73
Tin-base	104	97
Zinc-base	1	1
Total	505,464	383,548
Grand total	972,788	713,143

Consumption of copper-base scrap dropped 393,220 tons owing to lowered demand; however, less scrap was available. Sources of military scrap shrank because the armed services held from the market part of their accumulations of munition scrap for conversion to ingot. There was less plant demolition aud ship breakage, which provide old scrap, and costs of handling and transporting scrap were higher than in 1948. Secondary smelters, brass mills, foundries, and other plants using both refined copper and scrap in 1949 consumed 31 percent less scrap but 23 percent less refined metal in that year than in 1948, an indication that more refined copper than scrap was available.

Secondary copper smelters produced 200,046 tons of brass ingot in 1949, about a third less than in 1948. Their output of other products

was 15,892 tons of refined copper including shot, 13,185 tons of copper billets, 15,826 tons of brass-mill billets, and 2,243 tons of copper powder and chemicals. The principal raw material used by these smelters is copper-base scrap of which they consumed 273,988 tons, including 70,422 tons of composition and 48,488 tons of yellow brass scrap. Of the total copper-base scrap consumed, 84 percent was recovered in the products mentioned; the remaining 16 percent represents melting loss.

Analysis and production of secondary copper and copper-alloy products in the United States, 1948–49

Item produced from scrap	Approximate analysis (percent)						Gross weight produced (short tons)	
	Cu	Sn	Pb	Zn	Ni	Al	1948	1949
Unalloyed copper products:								
Refined copper (electrolytic grade)	100						231,899	211,169
Casting copper	99						25,349	17,245
Copper sheet, rod, tubing, etc.	99						20,989	17,323
Copper powder	98						2,324	2,273
Copper castings	98						3,465	2,079
Total							284,026	250,089
Brass and bronze ingots:								
Tin bronze	88	10		2			18,256	12,562
Leaded-tin bronze	88	6	1.5	4.5			17,934	10,689
Leaded red brass	85	5	5	5			120,178	71,813
Leaded semired brass	81	3	7	9			46,521	38,427
High-leaded-tin bronze	80	10	10				24,875	14,788
Do	84	6	8	2			8,137	4,592
Do	75	5	20				11,412	5,457
Leaded yellow brass	66	1	3	30			22,535	17,662
Manganese bronze	62			27		5	13,826	9,670
Aluminum bronze	89					10	2,063	2,200
Nickel silver	58	2	17	18	14		4,811	3,399
Do	65	4	3	5	22			
Low brass	80			20			2,642	1,812
Silicon bronze	92			4			2,467	2,233
Conductor bronze	94	2	2	2			685	399
Hardeners and special alloys	81						5,936	4,343
Total							[1] 302,278	[1] 200,046
Brass-mill billets made by ingot makers							6,881	2,641
Brass and bronze sheet, rod, tubing, etc.							[2] 416,413	[2] 265,439
Brass and bronze castings							[3] 135,092	[3] 99,419
Brass powder							1,333	886
Copper in chemical products (content)							17,612	14,840

[1] Gross weight of brass and bronze ingot. Includes 234,696 tons of copper, 9,593 tons of lead, 528 tons of nickel, 8,335 tons of tin, 36,944 tons of zinc, 74 tons of aluminum, and 12,108 tons of primary metals in 1948; and 158,000 tons of copper, 6,364 tons of lead, 439 tons of nickel, 5,693 tons of tin, 25,665 tons of zinc, 64 tons of aluminum, and 3,821 tons of primary metals in 1949.

[2] Gross weight of secondary brass and bronze in commercial shapes. Includes 290,430 tons of copper, 3,052 tons of nickel, 4,137 tons of lead, 354 tons of tin, 118,338 tons of zinc, and 102 tons of aluminum in 1948; and 189,027 tons of copper, 2,187 tons of nickel, 3,053 tons of lead, 221 tons of tin, 70,800 tons of zinc, and 151 tons of aluminum in 1949.

[3] Gross weight of secondary metal in brass and bronze castings. Includes 107,828 tons of copper, 39 tons of nickel, 13,635 tons of lead, 5,441 tons of tin, 8,535 tons of zinc, and 119 tons of aluminum in 1948; and 78,059 tons of copper, 45 tons of nickel, 10,381 tons of lead, 4,045 tons of tin, 6,727 tons of zinc, and 162 tons of aluminum in 1949.

Output of secondary refined copper, including both electrolytic and casting grades, totaled 241,685 tons in 1949 compared with 275,846 tons in 1948. Of the totals primary producers made all but 29,293 and 30,470 tons, respectively. Their secondary production, which decreased less than that of any other group, also included 1,149 tons of copper sulfate (copper content). In addition to their secondary output, primary refiners produced 927,927 tons of copper in

1949 and 1,107,446 tons in 1948 from primary raw materials. Consumption of copper scrap by this group totaled 415,498 tons in 1949, indicating a recovery of 51 percent, which is low because 275,356 tons of the total consumed was low-grade material. Of the 16 primary smelters and refineries which consumed scrap in 1949, 11 were operated by companies owning mines that provided at least part of the ores and concentrates consumed, and 5 were operated on a custom basis only.

Secondary metal recovered from scrap by brass mills totaled 269,577 tons in 1949 compared with 417,603 tons in 1948, representing a decrease of 35 percent. The corresponding drop for copper refiners was 14 percent, for the secondary smelters 31 percent, and for the foundries and miscellaneous manufacturers 25 percent. To obtain their production the brass mills used 276,169 tons of scrap, of which all but a few hundred tons were copper-base, achieving a recovery of 98 percent, the highest recovery of any type of consumer.

Consumption of old and new copper scrap in the United States in 1949, gross weight in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries				Total scrap used
			Brass mills		Foundries and other manufacturers		
	New scrap	Old scrap	New scrap	Old scrap	New scrap	Old scrap	
No. 1 wire and heavy	[1] 30,232	[1] 48,732	14,634	325	2,096	12,801	108,820
No. 2 wire, mixed heavy, and light	[1] 38,806	[1] 87,724	24,021	3,607	1,716	8,152	164,026
Composition or red brass	30,652	39,770			8,137	16,406	94,965
Railroad-car boxes		220				48,742	48,962
Yellow brass	11,905	36,583	187,775	3,541	4,716	13,389	257,909
Cartridge cases	8	2,188	1,247	10,971	2	2,275	16,691
Auto radiators (unsweated)		19,981					19,981
Electrotype shells		1,016				8	1,024
Bronze	3,486	17,172	1,048		13	7,415	29,134
Nickel silver	182	2,795	11,172	109	16	12	14,286
Low brass	1,368	69	16,694	343	685	1,351	20,510
Aluminum bronze	34	391	72		194	879	1,570
Low-grade scrap and residues	[1] 85,046	[1] 231,126				2,088	318,260
Total	201,719	487,767	256,663	18,896	17,575	113,518	1,096,138

[1] Of the totals shown primary refiners reported the following: Unalloyed copper scrap, 65,027 tons of new and 75,115 tons of old; low-grade scrap and residues, 61,852 tons of new and 213,504 tons of old.

The wrought products made by the brass mills require raw materials of high purity to give them the strength for which they were designed. Brass mills and wire mills used 98 percent of the refined copper consumed; the former were the largest consumers of high-grade zinc. It has been estimated that about 70 percent of all brass made is produced by hot rolling. The use of high-grade zinc in brass for such production is essential.[2] It follows that the refined copper and scrap used must also be of high purity. For most brass-mill products lead is the major impurity. Even as little as 0.02 percent may render them hot-short. In addition to other raw materials, the brass mills used 632 tons of brass ingot, chiefly phosphor copper and copper iron

[2] Freeman, J. R., Jr., Outlook for Zinc in Brass Industry: Am. Metal Market, vol. 57, No. 70, Apr. 14, 1950, pp. 5, 7.

hardeners, the latter in manganese-bronze and aluminum-bronze products. Scrapped brass and bronze castings and process scrap from finishing the castings usually contain lead and so cannot be used by brass mills. Most scrap consumed by brass mills is processed scrap returned to them by fabricator customers. This source is augmented by purchases from dealers. When operations are at a high level the proportion furnished by dealers may range from a third to a half or more. When activity is reduced the percentage purchased from dealers declines. The average percentage of scrap, including home scrap and purchased, in casting-department charges is estimated at as high as 75 percent at one of the larger mills. In some products a greater percentage of scrap can be used than in others. Cartridge-brass charges can be 100 percent scrap cartridge cases if the latter are free of extraneous material, such as steel cases, and are otherwise of good quality. Free turning-rod brass charges can contain a high percentage of scrap because the product may contain up to 3 percent lead. No scrap of any kind is used in making copper wire, first, because only copper of highest purity is used and, second, because the wire bars from which the wire is drawn are not cast in the brass or wire mills but are purchased from refineries. Most of the copper wire used for transmission purposes is made in the wire mills. Some of the process scrap generated in brass mills consists of scalpings—the surface layer removed from tube and sheet at certain stages in the milling operations to preclude surface defects in the finished product. Ordinarily 2 or 3 percent of the material processed is removed in this way, but the percentage may be increased if surface defects increase in the end products.

Skimmings and other residues generated in brass mills are usually sold to smelters, but at least one of the larger mills operates a scrap reclamation plant in which magnetic pulleys, screens, rolls, concentrating tables, cone classifiers, and other equipment are used to extract as much of the metallics as possible from the residues, either as concentrates or metal, some of which can then be used without refining. Since the scrap used by the brass mills is of such high quality, their recovery of secondary metal is better than that of any other type of plant using copper-base scrap.

An important installation, completed in 1949, was Scovill Manufacturing Co.'s new strip mill in which casting is continuous. The chief advantages over previous procedure are melt-to-melt chemical uniformity, avoidance of segregation in ingots cast, and savings in labor.[3]

A recent development in copper alloys is the addition of 0.5 percent tellurium to copper to improve machinability.[4] Based on a rating of 100 for free cutting brass the machinability of the tellurium alloy is 90 and that of copper 20. Selenium may be used in this alloy in place of tellurium. Another new copper alloy, developed at Battelle Memorial Institute and sponsored by the United States Army Signal Corps, is composed of 6.5 percent silver and 93.5 percent copper.[5] It has over 70 percent of the conductivity of copper and high tensile

[3] Roast, Harold J., Scovill's New Mill for Rolling Brass Strip: Metal Progress, vol. 57, No. 2, February 1950, pp. 197-200.

[4] Fontana, Mars G., Tellurium Copper: Ind. Eng. Chem., vol. 42, No. 2, February 1950, p. 73A.

[5] Hodge, Webster, and Rose, Kenneth, New Copper-Base Alloys Combine High Strength with High Conductivity: Materials and Methods, vol. 31, No. 1, January 1950, pp. 64, 65, 72.

strength of the order of 160,000 pounds per square inch, a combination that satisfies a wartime need.

The accompanying table illustrates the relative importance of scrap in comparison with other copper raw materials in the operations of the principal consumers. If the recovery factors for the different groups, as given in preceding pages of this section, are applied to the scrap-consumption figures and the items for each column then added, a close approximation of the copper-product output of each group will be obtained because the melting loss in consumption of the refined metals is small. Thus, the brass-mill production from copper-base scrap is 98 percent of 275,559 or about 270,000 tons. By adding to this the other figures in the brass-mill column a total output of 829,350 tons is obtained. According to figures recently published,[6] shipments of brass-mill products totaled 771,087 tons. This figure applies to operations of members of the Copper & Brass Research Association and certain other contributors of data.

Consumption of copper and brass materials in 1949, by principal consuming groups, in short tons

Item consumed	Primary producers	Brass mills	Wire mills	Foundries and miscellaneous	Secondary smelters
Copper-base scrap	415,498	275,559		131,093	273,987
Primary material	[1] 927,927				
Refined copper		478,126	677,223	21,808	4,463
Brass ingot		632	2,204	201,339	
Slab zinc		79,624			
Miscellaneous		968			9,015

[1] Recoverable copper content; gross weight not available.

Foundries use nearly all of the brass ingot produced by the secondary smelters and in addition some scrap and refined copper. In 1949 they used 111,980 tons of copper-base scrap, recovering 106,060 tons of secondary metal, or 95 percent, mostly in the form of castings. There are 64 brass-ingot makers, which supply the ingot needs of about 3,000 foundries, most of which are small plants. Their equipment usually is adapted only to simple remelting, so that the scrap used must be metallic rather than residues such as can be accommodated in the furnaces of the smelters. For this reason melting losses of foundries are less than those of the smelters and refiners. The most important scrap items for both custom brass foundries and secondary copper smelters are No. 1 Composition and yellow brass. The accompanying scrap-consumption table shows the most important item is railroad-car boxes of which 48,742 tons were consumed by foundries in 1949 and 62,807 tons in 1948; the plants using most of this type of scrap were foundries owned by railroads or bearing manufacturers.

Reported consumption of brass ingot in 1949 totaled 165,024 short tons compared with 229,620 tons in 1948. Brass and aluminum foundries were the principal consumers; these foundries and a few miscellaneous manufacturers used 162,188 tons of the total. Brass and wire mills used 2,836 tons, and 794 tons were exported in 1949

[6] American Bureau of Metal Statistics, 1949 Yearbook: New York, 1949, p. 27

compared with 4,322 tons and 424 tons, respectively, in 1948. Producers shipped 204,969 tons of brass ingot in 1949 and 302,910 tons in 1948. Assuming that shipments equal domestic consumption plus exports, this consumption survey achieved 81 percent coverage in 1949 compared with 76 percent in 1948. Over 3,300 plants were canvassed each year.

In the accompanying table the ingot consumption has been classified under nine general types and by regions formed by nine groupings of States according to the customary practice in preparing these statistics for the Minerals Yearbook. As in 1948, the region including Ohio and Illinois consumed more than any other—74,412 tons—and Ohio used more than any other State—26,090 tons. The region using the next largest total, 42,643 tons, was the Middle Atlantic in which the New York metropolitan area lies. These two regions together consumed 72 percent of the total quantity used by foundries. Consumption of composition ingot, the largest item, amounted to 93,907 tons or 58 percent of the total.

Foundry consumption of brass ingot in 1949, by States, in short tons

States	Tin bronze	Leaded tin bronze	Leaded red brass	High leaded tin bronze	Leaded yellow brass	Manganese bronze	Hardeners	Nickel silver	Low brass	Total
New England:										
Connecticut	154	2,225	2,410	440	1,421	55	22	7	94	6,828
Maine	18	2	152	88	-------	32	2	-------	20	314
Massachusetts	636	1,410	3,657	857	400	261	4	252	236	7,713
New Hampshire	117	89	636	63	378	44	1	-------	1	1,329
Rhode Island	65	161	410	31	27	3	2	-------	17	716
Vermont	-------	-------	57	2	-------	-------	-------	-------	-------	59
Total	990	3,887	7,322	1,481	2,226	395	31	259	368	16,959
Middle Atlantic:										
New Jersey	142	987	3,058	66	488	162	7	7	15	4,932
New York	962	2,460	7,028	960	252	902	70	273	314	13,221
Pennsylvania	2,241	2,608	13,337	1,672	1,389	1,644	866	92	641	24,490
Total	3,345	6,055	23,423	2,698	2,129	2,708	943	372	970	42,643
East North Central:										
Illinois	986	2,905	12,478	508	407	767	181	192	533	18,957
Indiana	75	140	4,654	595	148	133	271	56	33	6,105
Michigan	223	1,707	9,262	621	1,208	597	60	1	60	13,734
Ohio	1,558	5,881	14,956	1,883	818	492	62	44	396	26,090
Wisconsin	265	1,002	4,395	1,173	2,198	218	17	198	60	9,526
Total	3,107	11,635	45,745	4,780	4,774	2,207	591	491	1,082	74,412
West North Central:										
Iowa	186	69	704	54	466	160	-------	-------	-------	1,639
Kansas	3	44	75	1	99	1	1	-------	-------	224
Minnesota	53	355	1,487	52	243	41	3	-------	19	2,253
Missouri	160	252	1,440	5	883	48	49	1	384	3,222
Nebraska	-------	52	145	-------	-------	1	3	-------	-------	201
Total	402	772	3,851	112	1,691	251	56	1	403	7,539
South Atlantic:										
Delaware	22	-------	86	-------	-------	1	-------	-------	3	112
Dist. of Columbia	-------	-------	-------	-------	-------	2	9	-------	-------	11
Florida	-------	1	39	1	-------	2	-------	-------	-------	43
Georgia	3	210	93	1	-------	-------	-------	-------	1	308
Maryland	35	130	349	40	5	40	9	-------	21	629
North Carolina	-------	15	14	-------	144	-------	-------	-------	-------	173
South Carolina	-------	-------	4	-------	-------	-------	-------	-------	-------	4
Virginia	29	403	67	48	70	45	18	-------	-------	680
West Virginia	64	3	248	11	205	2	-------	-------	56	589
Total	153	762	900	101	424	92	36	-------	81	2,549

Foundry consumption of brass ingot in 1949, by States, in short tons—Continued

States	Tin bronze	Leaded tin bronze	Leaded red brass	High leaded tin bronze	Leaded yellow brass	Manganese bronze	Hardeners	Nickel silver	Low brass	Total
East South Central:										
Alabama	46	34	2,785	1	221	328	15	16		3,446
Kentucky	3	45	178	4	26	1	3			260
Mississippi	7		12							19
Tennessee	293	219	410	32	63	23	3	2		1,045
Total	349	298	3,385	37	310	352	21	18		4,770
West South Central:										
Arkansas	3		4							7
Louisiana	17	12	40	8		5			9	91
Oklahoma	54	376	72	16		5	1			524
Texas	150	90	664	98	2	156	1		38	1,199
Total	224	478	780	122	2	166	2		47	1,821
Mountain:										
Arizona		8	12							20
Colorado	52	24	29	8		2			4	119
Idaho			7							7
Montana							3			3
Utah	25	10	2			2				39
Total	77	42	50	8		4	3		4	188
Pacific:										
California	302	637	8,398	487	127	642	17	6	353	10,969
Oregon	75	26	34	2	11	21				169
Washington	24	38	19	5	6	75	2			169
Total	401	701	8,451	494	144	738	19	6	353	11,307
Grand total	9,048	24,630	93,907	9,833	11,700	6,913	1,702	1,147	3,308	162,188

All classes of consumers decreased their holdings of copper-base scrap in 1949. In November and December secondary smelters were operating with less than 30 days' supply on hand.

Consumers' stocks of copper-base scrap in the United States at end of year, 1948–49, gross weight in short tons

Scrap item	Dec. 31, 1948	Dec. 31, 1949
Unalloyed copper	15,241	12,937
Copper-base alloy	59,924	46,011
Low-grade scrap and residues	47,574	34,999
Total	122,739	93,947

Dealers' buying prices for No. 1 Composition scrap declined from 14.52 cents a pound in January to 8.18 cents in June, then increased to 11.18 cents in November, and finished the year at 10.93 cents, the average for the year being 10.35 cents. They started to drop several months before the first decrease of the year in the price of copper, and scrap prices began to recover about a month before the price of copper began to rise again. Prices for No. 1 Heavy copper scrap followed the same pattern as those of composition type, falling from 18.75 cents a pound in January to 10.80 cents in June, then increasing to 13.41 cents in December. The average for the year was 13.85 cents.

Brass and copper scrap imported into and exported from the United States, 1945–49, in short tons

	1945	1946	1947	1948	1949
Imports for consumption:					
Brass scrap	7,727	24,008	112,393	59,984	23,486
Scrap copper	1,348	1,030	5,957	9,334	6,765
Exports:					
Brass scrap	421	1,184	3,157	6,584	13,963
Scrap copper	133	909	969	2,266	8,284

SECONDARY LEAD

Lead recovery in the secondary lead industry decreased in 1949 for the second successive year, totaling 412,183 tons valued at $130,249,828 compared with 500,071 tons valued at $179,025,418 reclaimed in 1948, a decrease of 18 percent in quantity and 27 percent in value. The value of production for both years was computed on the basis of the yearly average weighted price of all grades of refined lead sold by producers, which was 17.9 cents per pound in 1948 and 15.8 cents in 1949. Recovery of lead from scrap, as metal and in alloys, did not exceed production of refined primary lead from domestic ores and base bullion as it had in the preceding 4 years but was greater than domestic mine production for the fourth successive year.

Secondary lead recovered in the United States, 1948–49, in short tons

Secondary lead recovered			Recoverable lead content of scrap		
Form of recovery	1948	1949	Kind of scrap processed	1948	1949
As metal:			New scrap:		
At primary plants	4,952	23,230	Lead-base	59,618	42,930
At other plants	126,951	129,396	Copper-base	7,720	5,113
Total	131,903	152,626	Total	67,338	48,043
In antimonial lead [1]	243,552	172,742	Old scrap:		
In other lead alloys	102,603	78,894	Battery lead plates	256,193	210,611
In copper-base alloys	21,499	7,440	All other lead-base	156,019	138,768
In tin-base alloys	514	481	Copper-base	20,497	14,738
			Tin-base	24	23
Total	368,168	259,557	Total	432,733	364,140
Grand total	500,071	412,183	Grand total	500,071	412,183

[1] Includes 49,525 tons of lead recovered in antimonial lead from secondary sources at primary plants in 1948 and 32,705 tons in 1949.

For the fifth consecutive year more scrap went into the production of refined soft lead and less into antimonial lead. Production of refined soft lead by secondary smelters and primary plants that used scrap metal in addition to ores, concentrates, and base bullion increased 16 percent—from 135,071 tons in 1948 to 156,910 tons in 1949—the secondary lead content being 131,903 and 152,626 tons, respectively. The secondary lead content of antimonial lead produced fell from 243,552 to 172,742 tons, a decrease of 29 percent. Secondary lead recovered in solder decreased for the first time in 4 years, and lead reclaimed in type metals declined for the third successive year. Recovery in lead-base babbitt dropped 36 percent. Total output of secondary lead and tin products was 17 percent lower than in

1948, less refined metal as well as less scrap metal being used in these products. Secondary smelters consumed 49,483 tons of primary lead, 9,953 tons of primary tin, 4,269 tons of primary antimony, and 2,731 tons of other materials as alloying ingredients with scrap in making specification alloys in 1949, compared with 52,760 tons, 17,649 tons, 6,697 tons, and 3,159 tons, respectively, in 1948.

Primary lead refineries recovered 14 percent or 56,852 tons of the total secondary lead recovered in 1949, in addition to 477,338 tons of refined lead produced from ores, concentrates, and base bullion. Of the 56,852 tons reclaimed from secondary material 23,230 tons were in refined lead, 32,705 tons in antimonial lead, and 917 tons in solder. The antimonial lead contained 3,385 tons of antimony, of which 1,775 tons came from scrap and 1,610 tons was added as primary metal. Primary plants also recovered 465 tons of tin from scrap metal, all in solder.

Secondary smelters and manufacturers recovered 86 percent of the total secondary lead produced in 1949, 98 percent of the secondary tin, and 90 percent of the secondary antimony. In comparison, 68 percent of the total secondary aluminum and 70 percent of the total secondary copper were recovered by plants other than primary producers and primary refineries. Comparison of data presented in the different sections of this chapter also indicates that the ratio of secondary lead recovered to primary lead produced was greater than the corresponding ratios for aluminum, copper, and zinc. In other words, the secondary lead recovered was greater in proportion to the total quantity of lead produced, both primary and secondary, than for secondary aluminum, copper, and zinc.

Shipments [1] of secondary lead, tin, and lead- and tin-alloy products in the United States in 1949, gross weight in short tons

Product	Gross weight of product [2]	Secondary metal content			
		Lead	Tin	Antimony	Copper
Refined pig lead	120,694	120,694			
Remelt lead	35,002	31,518			
Lead foil	1,214	414			
Total	156,910	152,626			
Refined pig tin	3,446		3,446		
Remelt tin	229		106		
Tin foil	19		19		
Total	3,694		3,571		
Lead and tin alloys:					
Antimonial lead	192,884	172,742	202	11,566	25
Common babbitt	26,267	19,782	1,148	2,231	151
Genuine babbitt	2,411	146	785	129	63
Other tin babbitts	1,203	335	299	55	18
Solder	61,785	31,884	7,762	421	4
Type metals	32,526	25,583	1,770	3,596	16
Miscellaneous lead-tin alloys	2,029	1,505	278	43	
Total	319,105	251,927	12,244	18,041	277
Composition foil	275	190	65	20	
Tin content of chemical products	608		608		

[1] Most of the figures herein represent shipments rather than production of the items involved. However, it has been necessary to record actual production figures in some instances.
[2] Difference between gross weight of products and secondary metal content represents added primary metals or impurity content.

Of the 412,183 tons of lead reclaimed in 1949, 392,332 tons were recovered from lead- and tin-base scrap, the remainder of 19,851 tons coming from copper-base scrap. A total of 1,284 tons of lead in lead- and tin-base scrap was added to brass and bronze to bring total recovery of secondary lead in copper-base alloys to 7,440 tons. Manufacturers and foundries recovered 97 percent of the lead scrap they consumed, and the primary and secondary smelters reclaimed 77 percent of the scrap metal treated. The former group consumed 11 tons of battery-lead plate scrap, whereas the smelters used 316,031 tons. Recovery of metal from this material is comparatively low—about 70 percent of the quantity consumed compared with 99 percent from soft lead scrap.

Consumption of old and new lead scrap in the United States in 1949, gross weight in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Soft lead		50,639	7	1,552	52,198
Hard lead		13,037		564	13,601
Cable lead		40,818		53	40,871
Battery-lead plates		316,031		11	316,042
Mixed common babbitt		7,067	29	11,166	18,262
Solder and tinny lead		11,738	1,173	267	13,178
Type metals		14,515		53	14,568
Dross and residues	68,620			1	68,621
Total	68,620	453,845	1,209	13,667	537,341

A total of 537,341 tons of lead-base scrap was treated in 1949. This quantity was 17 percent under the 643,560 tons used in 1948 and 20 percent under the 671,282 tons consumed in the peak year of 1947. Treatment of battery-lead plates decreased 68,389 tons (18 percent), soft lead 18,984 tons (27 percent), antimonial lead 7,350 tons (35 percent), common babbitt 1,494 tons (8 percent), type metals 2,962 tons (17 percent), and drosses and residues 19,377 tons (22 percent). Increases in use of scrap over 1948 were 33 percent in the use of cable lead and 20 percent in solder scrap. Smelters' highest operations of the year were in January, September, and March in the order listed and the lowest in July.

In 1949 the market in lead was unstable. Smelting charges per ton on battery plates had dropped to nothing near the end of 1948, advanced to a quoted $140 in March, gradually declined to $40 in July, rose again to $100 by October 1, and fell to $50 at the end of the year. A second mild winter cut the demand for replacement batteries and lessened manufacturers' demand for lead, and a shortage of copper due to strikes cut cable makers' demand for lead for cable covering.

Percentage and remelt metals circulated among remelters, smelters, and refiners in 1949 totaled 34,198 short tons consisting of 3,700 tons of solder, 2,718 tons of lead-base babbitt, 9,638 tons of soft lead, 15,048 tons of antimonial lead, 1,389 tons of type metals, 1,118 tons of cable lead, 472 tons of tin-base babbitt, 98 tons of remelt tin, and 17 tons of pewter.

Because of the downward trend in the lead market, smelters did not favor purchasing or holding large stocks of scrap but cut inventories during the year 34 percent—from 70,984 to 46,754 tons. Stocks of unalloyed lead were 19 percent higher on December 31, but lead-base alloy scrap dropped 47 percent and drosses and residues 11 percent. Smelters' stocks of secondary pig metals also decreased during the year from 29,900 to 27,053 tons.

Consumers' stocks of lead-base scrap in the United States at end of year, 1948–49, gross weight in short tons

Scrap item	Dec. 31, 1948	Dec. 31, 1949
Unalloyed lead	3,124	3,713
Lead-base alloy	47,952	25,280
Drosses and residues	19,908	17,761
Total	70,984	46,754

The price of primary lead remained at the peak of 21.5 cents a pound the first 2 months of the year and then steadily dropped until it reached 12.00 cents on May 26. On July 8 it increased to 13 cents and continued upward until August 18, when it reached 15.125 cents a pound. During this period the price changed nearly every day and so rapidly as to outnumber variations in scrap-lead prices, which are usually more sensitive than primary prices. On September 26 the price declined again to 14.75 cents and continued downward until it reached 12 cents on November 21, where it remained the rest of the year. Monthly averages of dealers' buying prices for heavy scrap lead in New York followed about the same pattern as prices of refined lead. The highest was 18.75 cents a pound in January; the average declined to 7.48 cents in June, then rose to 11.40 cents in August, and dropped to 9.16 cents in December. The average for the year was 10.91 cents.

General imports of lead scrap totaled 14,649 tons (lead content) in 1949 compared with 28,897 tons revised (lead content) in 1948.

SECONDARY MAGNESIUM

Secondary magnesium (including alloying ingredients) recovered from scrap in 1949 totaled 5,962 short tons valued at $2,444,420 compared with 7,553 (revised) short tons valued at $3,096,730 (revised) in 1948. Values were calculated for both years at 20.5 cents a pound, which had been the price of magnesium since January 1943. Primary production in 1949 was 11,598 tons, all from operations at the Freeport, Tex., plant of Dow Chemical Co. Consumption of primary magnesium, including pure magnesium and magnesium content of primary alloy, totaled 11,947 tons compared with 9,698 (revised) tons in 1948.

Secondary magnesium recovered in aluminum alloys was 29 percent of that so reclaimed in 1948, because of decreased consumption of aircraft scrap; that in magnesium castings was about half the quantity recovered in 1948. Recovery from scrap made into anodes for cathodic protection was 105 tons greater in 1949 than in 1948.

Although recovery of secondary magnesium in magnesium alloy ingot decreased 10 percent, its ratio to total secondary recovery increased from 62 percent in 1948 to 71 percent in 1949.

Secondary magnesium recovered in the United States, 1948–49, in short tons

Secondary magnesium recovered			Recoverable magnesium-alloy content of scrap		
Form of recovery	1948	1949	Kind of scrap processed	1948	1949
Magnesium-alloy ingot [1] (gross weight)	[2] 4,713	4,249	New scrap: Magnesium-base	[2] 3,365	3,023
Magnesium-alloy castings (gross weight)	1,301	681	Old scrap:		
Magnesium-alloy shapes	1	96	Magnesium-base	[2] 3,771	2,837
In aluminum alloys	[2] 998	294	Aluminum-base	417	102
In zinc alloys	6	4			
Chemical and other destructive uses	84	83	Total	[2] 4,188	2,939
Cathodic protection	450	555			
Grand total	[2] 7,553	5,962	Grand total	[2] 7,553	5,962

[1] Figures include secondary magnesium incorporated in primary magnesium ingot.
[2] Corrected figure.

Of the total quantity of magnesium recovered in secondary magnesium alloy ingot 2,278 tons were secondary ingot and 1,971 tons were incorporated in primary ingot. Consumption of secondary ingot, not including that incorporated in primary ingot, which cannot be measured, totaled 3,809 tons, including 1,502 tons in castings; 359 tons in ribbon, stick, and powder; 1,861 tons in aluminum alloys; 74 tons for cathodic protection; and 13 tons for miscellaneous uses.

Total consumption of magnesium scrap in 1949 was 6,458 tons, 18 percent less than in 1948, although use of primary magnesium, primary magnesium alloy, and secondary magnesium ingot increased. Old scrap constituted 48 percent of the total used in 1949 as compared with 52 (revised) percent in 1948. The price of remelt magnesium ingot was unchanged at 18 to 18.5 cents a pound (carlots) throughout 1949.

Stocks and consumption of magnesium scrap in the United States in 1949, gross weight in short tons

Scrap item	Stocks		Consumption during 1949
	Dec. 31, 1948	Dec. 31, 1949	
Cast scrap	[1] 2,654	2,113	3,426
Solid wrought scrap	898	737	2,776
Borings, grindings, drosses, etc	45	27	256
Total	[1] 3,597	2,877	6,458

[1] Corrected figure.

Magnesium scrap, as well as primary magnesium, primary magnesium alloy, and secondary magnesium alloy ingot, is used chiefly in the plants of the single primary magnesium producer, the primary aluminum producers, and a few other primary plants that also do most of the magnesium casting and rolling. Only three secondary smelters consumed important quantities of magnesium materials. The situation is different in other nonferrous metal operations. Scrap aluminum, copper, lead, tin, and zinc is consumed in numerous secondary plants not operated by primary producers, although the latter do use some scrap. In such circumstances magnesium scrap is less important to its consumers than other nonferrous scrap to its consumers, the secondary smelters, and other users.

Magnesium chips and turnings were reported to have been experimentally extruded as wire having a tensile strength of 42,500 pounds per square inch as compared with 39,500 for wire extruded from solid metal.[7] The composition of the alloy used was 94 percent magnesium and 6 percent aluminum. In other extrusion experiments powdered alloys of magnesium, aluminum, and zirconium were used in which the zirconium was precipitated to harden the matrix.

SECONDARY NICKEL

The recovery of secondary nickel from nonferrous scrap in 1949 totaled 5,680 short tons valued at $4,877,984, a decrease of 36 percent in quantity from the 8,850 tons valued at $6,966,720 recovered in 1948. The total value was calculated at 42.94 cents a pound in 1949 and 39.36 cents in 1948, the average spot-delivery prices of Grade F nickel ingots and shot in 10,000-pound lots at New York. The recovery declined because output of all the products in which nickel-bearing scrap is used decreased. Most of the recovery from copper-base nickel-bearing scrap and a large part of that from nickel-base alloy scrap was in the copper alloys nickel silver and cupro nickel. More nickel was recovered in brass-mill shapes than in any other product—2,187 tons in 1949 and 3,052 tons in 1948. Nickel recovered from nickel-base scrap amounted to 2,569 tons in 1949 compared with 4,516 tons in 1948 and from copper-base scrap, 2,440 tons in 1949 and 3,442 tons in 1948. Of the 1,201 tons of secondary nickel recovered in iron and steel in 1949, 1,060 tons were obtained from Monel metal scrap and the remainder from unalloyed nickel scrap. Aside from that obtained from scrap, the only production of nickel in the United States was as a byproduct from copper refining.

[7] Busk, R. S., and Leontis, T. E., Powdered Magnesium Alloys: Jour. of Metals, vol. 188, No. 2, February 1950, pp. 297-306.

Secondary nickel (nonferrous) recovered in the United States, 1948–49, in short tons

Secondary nickel recovered			Recoverable nickel content of scrap		
Form of recovery	1948	1949	Kind of scrap processed	1948	1949
As metal	99	46	New scrap:		
In nickel-base alloys	1,850	1,062	Nickel-base	2,581	1,335
In copper-base alloys	3,467	2,438	Copper-base	2,875	1,958
In aluminum-base alloys	889	668	Aluminum-base	488	473
In lead-base alloys	6	21			
In cast iron and steel [1]	2,304	1,201	Total	5,944	3,766
In chemical compounds	235	244			
			Old scrap:		
Grand total	8,850	5,680	Nickel-base	1,935	1,234
			Copper-base	567	482
			Aluminum-base	398	193
			Lead-base	6	5
			Total	2,906	1,914
			Grand total	8,850	5,680

[1] Includes only nonferrous nickel scrap added to cast iron and steel.

Consumption of nickel scrap totaled 18,160 tons in 1949 compared with 26,688 tons in 1948. The chief nickel-bearing scrap items are nickel silver, which is copper-base material and Monel metal; 14,286 tons of nickel silver, from which most secondary nickel is obtained, was used in 1949 compared with 20,145 tons in 1948. Consumption of Monel scrap decreased from 5,014 tons in 1948 to 3,003 tons in 1949. Monel is a nickel-copper alloy that contains 67 percent nickel and 30 percent copper; the remainder is mostly iron and manganese. It is obtained by roasting copper-nickel converter matte and reducing the resulting oxide to metal with charcoal.[8] Compositions of other Monel-metal types in commercial use vary a little from that given. Much stainless steel contains nickel; the 87,694 tons of stainless-steel scrap consumed in[9] 1949 probably contained several thousand tons, but tabulation of the secondary nickel recovered in the steel to which this scrap was added would be difficult because of the varying nickel content of the numerous types of stainless-steel scrap used.

Consumption of old and new nickel scrap in the United States in 1949, gross weight in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Unalloyed nickel	91	196	22	101	410
Monel metal	221	913	1,510	359	3,003
Nickel silver [1]	182	2,795	11,188	121	14,286
Miscellaneous nickel alloys	51				51
Nickel residues	11		137	262	410
Total	[illegible]	3,904	12,857	843	18,160

[1] Copper base scrap, so tabulated, except in this table.

[8] Wickenden, T. H., The Nickel Industry: Metals Handbook, 1948 ed., pp. 1025–1027.
[9] Melcher, Norwood B., and Larkin, James E., United States Bureau of Mines Iron and Steel Report: No. 110, December 1949, p. 2.

According to the American Metal Market the spot-delivery price of Grade F nickel ingots and shot in 10,000-pound lots at New York was 42.90 cents a pound at the beginning of 1949 and 42.97 cents at the end; the average for the year was 42.94 cents. The change was caused by increases in freight rates. Scrap-metal dealers' buying prices at New York at the beginning of 1949 were quoted at 21 cents a pound for nickel sheet and clippings and 16 cents for Monel-metal clippings. Although the price of primary nickel increased slightly during the year, nickel scrap prices declined. The price of nickel sheet and clippings dropped to 18 cents on June 20 and that of Monel clippings to 14 cents on April 5 and to 12 cents on June 20, after which the prices remained unchanged to the end of the year.

No imports of nickel scrap were reported in 1948 or 1949, but exports in 1949 totaled 2,784 tons compared with 5,826 tons in 1948 and 8,424 tons in 1947.

Consumers' stocks of nonferrous nickel scrap [1] in the United States at end of year, 1948–49, gross weight in short tons

Scrap item	Dec. 31, 1948	Dec. 31, 1949
Unalloyed nickel	261	139
Nonferrous nickel alloys	2,758	2,866
Nickel residues	2,262	104
Total	5,281	3,109

[1] Includes nickel-silver scrap.

SECONDARY TIN

Recovery of secondary tin from scrap in 1949 totaled 24,901 short tons valued at $49,461,354 compared with 30,124 tons valued at $59,796,140 reclaimed in 1948. All of the secondary tin produced in 1949, except 465 tons recovered by primary lead refineries, was reclaimed by secondary smelters, detinners, manufacturers, and foundries. All but a small percentage of the refined tin from ores and concentrates smelted in the United States was produced by the Government-owned smelter at Texas City; the output of which was 40,379 short tons.

The tin-recovery table is double, as are those in the sections devoted to the other nonferrous secondary metals. It shows secondary tin recovered according to composition on the left and according to class of scrap processed on the right side. The data on the left side are compiled from individual plant outputs and those on the right by calculating the tin that could be recovered from the quantities of the different kinds of scrap reported used. The totals so derived for each side of the table do not agree because of slight errors introduced by the necessity of assuming recovery factors. As presented here, however, the items have been adjusted to give the exact balance theoretically expected. The word "recovery" thus may be applied to both sides of the table.

Secondary tin recovered in the United States, 1948–49, in short tons

Secondary tin recovered		
Form of recovery	1948	1949
As metal:		
At detinning plants	3,304	3,265
At other plants	204	287
Total	3,508	3,552
In solder	7,404	7,762
In tin babbitt	1,040	1,084
In chemical compounds	580	608
In lead-base alloys	4,810	3,463
In brass and bronze	12,782	8,432
Total	26,616	21,349
Grand total	30,124	24,901

Recoverable tin content of scrap		
Kind of scrap processed	1948	1949
New scrap:		
Tin plate	3,561	3,543
Tin-base	1,281	854
Lead-base	1,970	1,926
Copper-base	3,222	2,055
Total	10,034	8,378
Old scrap:		
Tin cans	106	111
Tin-base	3,346	2,976
Lead-base	5,349	5,592
Copper-base	11,289	7,844
Total	20,090	16,523
Grand total	30,124	24,901

Detinning plants produced 3,195 tons of pig tin from old tin cans and new tin-plate clippings and 70 tons from tin-base scrap and residues; in addition, secondary smelters recovered 287 tons of pig tin. The total of 3,552 tons of unalloyed tin reclaimed from scrap was 1 percent above the quantity recovered in 1948. Recovery of all secondary tin, as metal, in alloys, and in compounds, decreased 17 percent. Increased recovery in solder, tin babbitt, and chemical compounds was overbalanced by a 28-percent decline in lead-base alloys and a 34-percent drop in brass and bronze. Shipments of secondary tin and lead-tin alloys are presented in the Lead section of this chapter. In addition to metallic products, secondary smelters produced, from lead- and tin-base scrap, tin salts with a recoverable tin content of 83 tons in 1949. These chemicals, sodium stannate and tin tetrachloride, were shipped to detinning plants for further treatment.

Consumption of tin-base scrap decreased 20 percent in 1949; less of all types of scrap except pewter were consumed. Use of block-tin pipe and high-tin babbitt dropped 18 and 8 percent, respectively, below the quantity treated in 1948.

Consumption of old and new tin scrap in the United States in 1949, gross weight in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Block-tin pipe, scrap, and foil		819	8	61	888
Tin scruff and dross	1,380		3		1,383
No. 1 pewter		143			143
High-tin babbitt		2,271		96	2,367
Residues	36			4	40
Total	1,416	3,233	11	161	4,821

The price of primary tin held steadily at $1.03 a pound until September 28, when it dropped to 96 cents. There were nine additional decreases during the last 3 months, and on December 31 the Reconstruction Finance Corporation selling price, New York, was 77.50 cents.

General Preference Order M-43, controlling the distribution and use of secondary as well as primary tin, was extended for another year on June 30. However, on August 25, when it appeared that supplies were adequate to meet the needs of industry and the strategic stockpile, restrictions on end use were abolished, while allocation controls continued.

As in 1948, tin-base scrap exports exceeded domestic consumption, totaling 10,332 short tons in 1949 and 8,813 in 1948. They were largely drosses and residues containing a number of metals including tin—the element of greatest value—and were consigned chiefly to Capper Pass & Son plants in England, which have specialized in treating such material for many years.

Consumers' stocks of tin-base scrap in the United States at end of year, 1948–49, gross weight in short tons

Scrap item	Dec. 31, 1948	Dec. 31, 1949
Unalloyed tin	121	35
Tin-base alloys	585	746
Drosses and residues	615	512
Total	1,321	1,293

Smelters' total stocks of tin scrap, which had gained 25 percent in 1948, remained almost unchanged in 1949. The 2-percent decrease was in unalloyed tin and the drosses, but stocks of tin-base alloys increased 28 percent. Dealers' buying price for scrap block-tin pipe dropped eight times from 83.50 cents a pound on January 1 to 64 cents in December, the average for the year being 74.08 cents.

Detinning Plants.—Eight detinning plants reported recovery operations in 1948: Johnston & Jennings Co., Cleveland, Ohio; Metal & Thermit Corp., South San Francisco, Calif., East Chicago, Ind., and Carteret, N. J.; Standard Metal Refining Co., Baltimore, Md.; Vulcan Detinning Co., Sewaren, N. J., Neville Island, Pittsburgh, Pa.; and Tin & Chemical Corp., Baltimore, Md.

Secondary tin recovered at detinning plants in the United States, 1948–49

	1948	1949
Scrap treated:		
Clean tin plate........long tons....	376,620	387,468
Old tin-coated containers........do.....	15,079	15,382
Total........do.....	391,699	402,850
Tin recovered from new tin-plate clippings........short tons..	3,561	3,543
Tin recovered from old tin-coated containers........do.....	106	111
Total........do.....	3,667	3,654
Tin recovered as metal........do.....	[1] 3,284	[1] 3,195
Tin recovered in compounds........do.....	383	459
Total........do.....	[2] 3,667	[2] 3,654
Weight of tin compounds produced........do.....	735	932
Average quantity of tin recovered per long ton of clean tin-plate scrap used........pounds..	18.91	18.29
Average quantity of tin recovered per long ton of old tin-coated containers used........pounds..	14.10	14.43
Average delivered cost of clean tin-plate scrap........per long ton..	$37.48	$25.21
Average delivered cost of old tin-coated containers........do.....	$27.45	$19.69

[1] Includes a small tonnage of pig tin of less than standard purity and, consequently, subject to further refining or alloying.
[2] Recovery from tin-plate clippings and old containers only. In addition, detinners recovered 20 tons of tin as metal and 107 tons of tin in compounds from tin-base scrap and residues in 1948 and 144 tons of tin as metal and in compounds from these sources in 1949.

Secondary tin recovered by detinning plants, as metal and in chemical compounds, was virtually unchanged in 1949. The total tin recovered was 3,798 short tons in 1949 and 3,794 in 1948. Tin-plate clippings and old cans were the source of 3,654 tons in 1949, of which 3,195 was reclaimed as metal in the form of pigs and 459 tons in the form of tin compounds. During 1948 such material provided 3,667 tons comprising 3,284 tons of metal and 383 tons in compounds. The treatment of other tin-bearing materials accounts for the remaining production of 144 tons in 1949 and 127 in 1948.

The industry reported treating 387,468 long tons of tin-plate clippings in 1949. This was the largest on record, and exceeded the previous peak reached in 1948 by nearly 3 percent. The earlier peak year of 1941 was exceeded by 14 percent. The average cost of such clippings delivered at plants decreased from $37.48 a long ton in 1948 to $25.21 in 1949, responding to a proportional reduction in the price of No. 1 Heavy-Melting steel scrap. Old cans processed increased 2 percent to 15,382 long tons in 1949, compared with 15,079 tons in 1948 and the record of 175,870 tons in 1943. Tin recovered from tin-plate clippings in 1949 totaled 3,543 short tons, slightly less than in 1948; while that from old cans—111 tons (mostly in the form of pig tin)—increased 5 percent.

The average quantity of tin recovered per long ton of tin-plate scrap treated was 18.29 pounds in 1949 against 18.91 pounds in 1948. Before the introduction of electrolytic tin plate and wartime restrictions on the weight of tin on the hot-dipped product recoveries averaged around 37 pounds per ton of material detinned. Lower recoveries per unit for the most part reflect the treatment of a larger proportion of electrolytic tin plate carrying a much thinner coating of tin than the heavier coated hot-dipped product. The use of electrolytic tin plate has been expanding in the manufacture of cans (both

general line and packers' or sanitary) and closures. The average quantity of tin recovered per long ton of old tin-coated containers used increased to 14.43 pounds in 1949, compared with 14.10 pounds in 1948, but was considerably below the 22.58 pounds recorded for 1943.

Imports of tin-plate scrap were 41,028 long tons in 1949 against 41,084 in 1948 (detinned, this material would provide the equivalent of about 400 tons of tin). No exports of tin-plate scrap were recorded for 1948 and 1949.

SECONDARY ZINC

Secondary zinc recovered in 1949 from purchased scrap and residues totaled 237,813 short tons, with a value of $58,977,624, calculated at 12.4 cents a pound, the yearly average weighted price of all grades of refined zinc sold by producers. This tonnage was 27 percent lower than in 1948, when 324,639 tons with a value of $86,353,974 at 13.3 cents a pound were recovered. Output of primary slab zinc in 1949 totaled 814,782 tons compared with 787,764 tons in 1948.

Secondary zinc recovered [1] in the United States, 1948–49, in short tons

Secondary zinc recovered			Recoverable zinc content of scrap		
Form of recovery	1948	1949	Kind of scrap processed	1948	1949
As metal:			New scrap:		
By distillation:			Zinc-base	139,673	112,177
Slab zinc	[2] 61,725	54,559	Copper-base	110,288	73,531
Zinc dust	29,457	20,895	Aluminum-base	488	454
By remelting	10,988	8,722	Total	250,449	186,162
Total	[2] 102,170	84,176	Old scrap:		
In zinc-base alloys	12,884	11,216	Zinc-base	26,199	25,002
In brass and bronze	[2] 159,768	104,386	Copper-base	47,663	26,496
In aluminum-base alloys	822	611	Aluminum-base	328	153
In chemical products:					
Zinc oxide (lead-free)	12,327	12,394	Total	74,190	51,651
Zinc sulfate	3,758	4,418			
Zinc chloride	13,980	11,366	Grand total	324,639	237,813
Lithopone	18,213	8,588			
Miscellaneous	717	658			
Total	[2] 222,469	153,637			
Grand total	324,639	237,813			

[1] Zinc content.
[2] Revised figure.

Recovery of zinc from copper-base scrap declined 37 percent in 1949 because of decreased copper-base scrap consumption. Much of the 17-percent decrease in recovery of zinc from zinc-base scrap can be attributed to lower consumption of slab zinc in galvanizing and to still lower generation of scrap in galvanizing operations. In years such as 1949, when there was no oversupply of scrap material, consumption varies with availability. Galvanizers' dross, the chief zinc-scrap item, forms in galvanizing pots as the result of the attack of the molten zinc on articles galvanized and on the walls of the pots. In the continuous galvanizing process, use of which has been increasing since the end of World War II, less dross is formed than when the ordinary hot-dip galvanizing method is used. The temperature and composi-

tion of the molten zinc bath can be better controlled when the continuous process is used. It was reported early in 1950 that seven continuous lines were then in operation and three more were under construction.[10] Installation costs are said to be high, but labor savings and improvement in quality of product are compensating factors. Advantages claimed for an induction galvanizing furnace, placed on the market in 1949, were reduced dross formation and longer life on account of its refractory lining. About 5 percent of all galvanizing in 1949 was done by electrical methods.

In intervals between wars the proportion of slab zinc used in brass and bronze tends to decrease and that used in galvanizing to increase; this tendency is reflected in quantities of zinc recovered from different types of scrap. Recovery of zinc from copper-base scrap represented 42 percent of the total secondary recovery in 1949 as compared with 49 percent in 1948.

Secondary zinc reclaimed in brass and bronze, most of which came from brass scrap, was 35 percent less than in 1948. The total recovered as redistilled slab, in zinc dust, remelt zinc, and zinc-base alloys dropped 17 percent. Recovery in chemical products declined 24 percent chiefly because of reduction in the quantity of secondary lithopone produced.

The total number of producers of zinc dust and redistilled slab was 25 in 1949 as compared with 23 in 1948. Several plants that distilled zinc scrap in 1948 did not do so in 1949 and vice versa. Most zinc dust is made from scrap, but one plant made this product entirely from primary material in 1949. There were 5 plants that made both zinc dust and redistilled slab, 6 that made zinc dust only, and 14 that made slab only. Of the plants that reported using scrap in distillation operations 9 used chiefly primary raw materials, whereas the other 16 were classed as secondary plants.

Production of secondary zinc and zinc-alloy products in the United States, 1945–49, gross weight in short tons

Products	1945	1946	1947	1948	1949
Redistilled slab zinc	49,240	44,516	59,542	[1] 62,320	55,041
Zinc dust	23,892	26,002	28,334	29,932	21,243
Remelt spelter [2]	8,090	8,212	7,443	7,796	6,045
Remelt die-cast slab	4,727	7,829	8,595	10,543	8,266
Zinc-die and die-casting alloys	2,281	3,002	2,698	3,377	3,873
Galvanizing stock	701	876	774	580	406
Rolled zinc	3,054	2,729	2,341	2,778	2,775
Secondary zinc in chemical products	41,866	45,029	55,525	48,995	37,424

[1] Revised figure.
[2] Contains small tonnages of bars, anodes, etc.

Total zinc-base scrap consumption decreased 18 percent in 1949. The only increase was 12 percent in use of scrap die castings. Aluminum and zinc die castings compete in many fields, especially in the automobile industry. Data published by the Bureau of the

[10] White, F. G., Developments in Galvanizing: Am. Metal Market, vol. 57, No. 68, Apr. 12, 1950, p. 9.

Census in Facts for Industry bulletins indicate that shipments of aluminum die castings decreased 26 percent in 1949. Reports to the Bureau of Mines reveal that consumption of slab zinc in die castings decreased 14 percent in the same period, indicating a gain for zinc over aluminum.

Consumption of old and new zinc scrap in the United States in 1949, gross weight in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Clippings	3,737		3,925		7,662
Sheet and strip		4,333		101	4,434
Engravers' plates		1,304		87	1,391
Skimmings and ashes	47,154		28,616		75,770
Dross	55,258		3		55,261
Die castings		22,789	611	329	23,729
Rod and die scrap		1,712			1,712
Flue dust	5,129		8,831		13,960
Chemical residues	10,530		6,428		16,958
Total	121,808	30,138	48,414	517	200,877

Manufacturers and foundries consumed a total of 48,931 tons of zinc scrap in 1949, of which 5,053 tons were metallic scrap and 43,878 tons byproduct residues. Foundries consume very little zinc scrap. Most of the metallic scrap was used by die casters, brass mills, galvanizers, and zinc rolling mills. The residues were consumed by chemical plants. The zinc in these materials is chiefly in oxide or chloride form, easily soluble, or already in the chemical combination desired. Zinc oxide can be produced by chemical processes as in the manufacture of sodium hydrosulfite or in smelting operations such as roasting metallic zinc scrap or zinc ore. More zinc oxide is made from primary materials rather than from scrap, but the other zinc chemicals, except lithopone, are made chiefly from scrap and residues.

Smelters recovered 71 percent, and manufacturers and foundries 61 percent of the zinc contained in the scrap treated. These recoveries are relatively low, not because of inefficient operation of plants but because so much of the scrap treated was byproduct residues containing a low proportion of zinc. Chemical plants reclaim virtually all of the zinc contained in residues because there is no melting loss in chemical reactions, whereas in smelting operations some metal is lost in skimmings and flue dust.

Dealers' buying prices for new zinc clippings averaged 7.28 cents a pound in 1949 compared with 9.42 cents in 1948 and 7.16 cents in 1947. The quotations were highest in January, averaging 12.44 cents for that month; thereafter they declined to 4.91 cents in June and then increased to 5.97 cents in December. The prices for old zinc scrap followed the same trend as that for clippings. The average for January was 9.94 cents and the lowest monthly average was 3.45 cents in July. In December the average had risen to 4.50 cents. The average price for the year was 5.45 cents compared with 7.01 cents in 1948 and 5.37 cents in 1947.

Consumers' stocks of zinc-base scrap in the United States at end of year, 1948–49, gross weight in short tons

Scrap item	Dec. 31, 1948	Dec. 31, 1949
Metallic zinc scrap	3,878	4,190
Dross	8,560	6,925
Skimmings and residues	23,337	19,101
Total	35,775	30,216

United States imports of old zinc scrap totaled 1,064 tons in 1949 compared with 1,636 tons in 1948. Imported drosses and residues totaled 2,668 tons in 1949, a decrease of 5,969 tons from the 8,637 tons imported in 1948. Large quantities of fume from a primary smelter in Canada were imported by one company for the manufacture of zinc sulfate and lithopone; the zinc reclaimed from this material was not recorded as secondary zinc but as recovered from material other than scrap. Exports of old zinc scrap in 1949 were 1,570 tons.

Slag—Iron Blast Furnace

By D. G. Runner

GENERAL SUMMARY

THE iron-blast-furnace-slag processing industry established a new record in 1949. Sales of screened air-cooled slag for use in highway construction, including portland-cement concrete and bituminous types, were greater than during the preceding year. Slag stocks are normally small and constant from year to year; therefore production virtually equals sales, and hence these terms are used interchangeably in this chapter. As indicated in the accompanying salient statistics table, sales in 1949 of air-cooled and granulated slag exceeded those reported for the previous year, but expanded slag declined slightly.

Although a great amount of literature on the production and uses of blast-furnace slag has been accumulating over many years, no comprehensive treatise encompassing this information had been published in English. However, a recent Bureau of Mines Bulletin,[1] sponsored by the National Slag Association, contains information of value to engineers, contractors, and architects.

Iron blast-furnace slag processed in the United States, 1945–49, by types

[National Slag Association]

Year	Air-cooled						Granulated			Expanded		
	Screened			Unscreened			Short tons	Value		Short tons	Value	
	Short tons	Value		Short tons	Value			Total	Average per ton		Total	Average per ton
		Total	Average per ton		Total	Average per ton						
1945	11,427,689	$9,841,813	$0.86	406,775	$140,527	$0.35	567,297	$132,581	$0.23	234,107	$335,931	$1.43
1946	14,332,896	13,250,693	.92	596,957	211,078	.35	1,003,789	[1] 86,383	------	773,150	1,321,685	1.71
1947	16,712,177	17,045,020	1.02	447,908	257,683	.58	1,290,958	[1] 95,087	------	1,130,636	2,127,692	1.88
1948	17,656,200	19,254,900	1.09	604,100	370,000	.61	1,517,500	[1] 184,700	------	1,353,200	2,550,400	1.88
1949	17,769,330	21,090,445	1.19	727,595	372,727	.51	1,885,428	[1] 416,632	------	1,199,026	2,698,908	2.25

[1] Excludes value of slag used for cement manufacture.

PRODUCTION

The output of slag from iron blast furnaces in 1949 amounted to 30,093,957 short tons compared with 33,735,712 tons reported for the preceding year.

The quantity of slag processed for commercial use in 1949, according to reports of processors to the National Slag Association and the

[1] Josephson, G. W., Sillers, F., Jr., and Runner, D. G., Iron Blast-Furnace Slag: Production, Processing, Properties, and Uses: Bureau of Mines Bull. 479, 1949, 304 pp.

Bureau of Mines, reached a new high of 21,581,379 short tons valued at $24,578,712. These totals are 2 and 10 percent, respectively, above the preceding year's figures of 21,131,000 short tons valued at $22,360,000. The output in 1949 came from 66 plants processing air-cooled slag and 10 plants processing expanded slag. In all, 41 companies were engaged in processing air-cooled slag and 7 companies manufacturing expanded slag. Two companies began manufacturing expanded slag—the Lone Star Steel Co. at Lone Star, Texas, and the Steelton Foam Slag Co. at Steelton, Pa.

During 1949, iron blast-furnace slag was processed in the following States: Alabama, California, Colorado, Illinois, Indiana, Kentucky, Maryland, Michigan, New York, Ohio, Pennsylvania, Texas, and West Virginia. The majority of the plants are east of the Mississippi River, with Ohio, as in 1948, being the largest processor. Alabama and Pennsylvania follow in order. These three States supplied 61 percent of the total tonnage reported during 1949. The accompanying table shows the available details, by States, in 1949.

Iron blast-furnace slag processed in the United States, by States, in 1949

[National Slag Association]

State	Screened air-cooled			All types		
	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total	
Alabama	3,666,461	21	$3,636,350	4,217,515	20	$4,418,300
Ohio	4,542,424	25	6,021,524	5,534,147	25	6,624,216
Pennsylvania	2,895,944	16	4,090,795	3,374,048	16	4,482,596
Other States [1]	6,664,501	38	7,341,776	8,455,669	39	9,053,600
Total	17,769,330	100	21,090,445	21,581,379	100	24,578,712

[1] California, Colorado, Illinois, Indiana, Kentucky, Maryland, Michigan, New York, Texas, and West Virginia.

PREPARATION

Processed blast-furnace slag is usually marketed in air-cooled (screened or unscreened), granulated, or expanded form. The bulk of slag used today is of the air-cooled variety, the formation of which is characterized by slow cooling. In the production of air-cooled slag the molten material may be allowed to flow from the furnace into ladles in which it is transported to a slag bank or modified pit, or it may be allowed to flow into pits adjacent to the furnace. After the slag has solidified it is cooled, usually with a water spray, with subsequent cracking in the different layers. This condition facilitates excavating operations. After excavation the slag is crushed or screened, as with natural aggregates, for concrete aggregate, railroad ballast, and for many industrial purposes. Granulated slag is the granular product formed when molten slag is suddenly chilled by immersion in water. It is made by three general methods: Pit, jet, and dry granulation processes. Expanded slag is the foamed product formed when molten slag is expanded by applying a limited quantity of water.

Commercial slag contains only a small amount of free iron owing to the fact that during the processing stages it is passed over magnetic separators. Hand picking also is done in certain instances.

TRANSPORTATION

The bulk of slag processed in 1949 was moved by rail and truck. Only relatively small quantities were moved by waterway. As shown in an accompanying table, railroads handled 47 percent and trucks 51 [illegible]

truck shipments have increased correspondingly.

Shipments of iron blast-furnace slag in the United States, by methods of transportation, 1948–49

[National Slag Association]

Method of transportation	1948		1949	
	Short tons	Percent of total	Short tons	Percent of total
Rail	11,066,400	54	9,961,117	47
Truck	9,215,500	45	10,921,641	51
Waterway	145,200	1	401,785	2
Total shipments	20,427,100	100	21,284,543	100
Added to stocks	703,900		296,836	
Total processed	21,131,000		21,581,379	

CONSUMPTION

Screened air-cooled slag was the major product of the industry, accounting for 82 percent of the total slag processed during 1949. Granulated slag comprised 9 percent, expanded slag 6 percent, and unscreened air-cooled slag 3 percent.

Screened Air-Cooled Slag.—Consumption of screened air-cooled slag reached an all-time high of 17,769,330 short tons valued at $21,090,445—113,130 tons above the previous record year of 1948. The use of screened air-cooled slag as aggregate in portland-cement concrete construction, bituminous construction, other road-construction uses, and as railroad ballast consumed 15,879,737 short tons or 89 percent of the total for this type of slag. Other principal uses for this material were in the manufacture of concrete block, mineral wool, and roofing (built-up and granules).

Unscreened Air-Cooled Slag.—In 1949 the quantity of unscreened air-cooled slag processed totaled 727,595 short tons valued at $372,727—increases of 20 and 1 percent, respectively, over the 1948 figures. About half of this material was used in road construction.

Granulated Slag.—The consumption of granulated slag in 1949 amounted to 1,885,428 short tons—24 percent above the 1,517,500 tons reported in 1948. The principal uses for this material were in the manufacture of hydraulic cement and as road fill. These two uses consumed 79 percent of the total processed. The granulated slag was used in roads as insulation courses and as fill material. Granulated

Air-cooled iron blast-furnace slag sold or used by processors in the United States, by uses, in 1949

[National Slag Association]

Use	Screened		Unscreened	
	Short tons	Value	Short tons	Value
Aggregate in:				
Portland-cement concrete construction	1,842,381	$2,272,912		
Bituminous construction (all types)	4,278,417	5,466,366		
Highway construction [1]	5,982,195	7,633,776	320,277	$163,673
Airport construction [1]	136,485	166,704		
Manufacture of concrete block	719,823	836,391		
Railroad ballast	3,776,744	3,285,562	14,737	6,654
Mineral wool	439,358	592,683		
Roofing (built-up and granules)	208,391	346,454		
Sewage trickling filter medium	41,711	63,737		
Agricultural slag, liming	41,444	58,520		
Other uses	302,381	367,340	392,581	202,400
Total	17,769,330	21,090,445	727,595	372,727

[1] Other than in portland-cement concrete and bituminous construction.

slag is used by the Ohio State Highway Department, using Vibro-Tamper compaction machines, for bases under both rigid or flexible-type pavements.[2]

Expanded Slag Aggregate.—Consumption of expanded slag manufactured from molten slag declined slightly from the previous year. Sales amounted to 1,199,026 short tons valued at $2,698,908—representing a decrease of 11 percent quantitywise but an increase of 6 percent in dollar value. It is reported that the output was utilized principally as aggregate in the manufacture of concrete block.

Granulated and expanded iron blast-furnace slag sold or used by processors in the United States, by uses, in 1949

[National Slag Association]

Use	Granulated		Expanded	
	Short tons	Value	Short tons	Value
Road fill, etc	559,187	$193,453		
Agricultural slag, liming	35,923	42,030		
Manufacture of hydraulic cement	927,383	(1)		
Aggregate for concrete block manufacture	78,865	85,924	1,199,026	$2,698,908
Other uses	284,070	95,225		
Total	1,885,428	(1)	1,199,026	2,698,908

[1] Data not available.

PRICES

Average prices per ton for the various types of slag processed in 1949 are shown in an accompanying table. Values for screened air-cooled slag ranged from 87 cents for railroad ballast to $1.66 for slag used in the roofing industry. Unscreened air-cooled slag values ranged from 45 cents for railroad ballast to 51 cents for slag used in highway work (other than in portland-cement concrete and bituminous construction) and for "other uses." Available value figures on

[2] Slag Runner, vol. 1, No. 5, Apr. 15, 1949, pp. 1–2.

granulated slag ranged from 34 cents for "other uses" to $1.17 for agricultural slag, whereas the average value for expanded slag was $2.25.

Average value per short ton of iron blast-furnace slag sold or used by processors in the United States in 1949, by uses

[National Slag Association]

Use	Air-cooled		Granulated	Expanded
	Screened	Unscreened		
Aggregate in:				
Portland-cement concrete construction	$1.23			
Bituminous construction (all types)	1.28			
Highway construction [1]	1.28	$0.51		
Airport construction [1]	1.22			
Manufacture of concrete block	1.16		$1.09	$2.25
Railroad ballast	.87	.45		
Mineral wool	1.35			
Roofing (built-up and granules)	1.66			
Sewage trickling filter medium	1.53			
Agriclutural slag, liming	1.41		1.17	
Road fill, etc			.35	
Other uses	1.21	.51	.34	

[1] Other than in portland-cement concrete and bituminous construction.

IRON RECOVERY

Iron recovered in processing slag amounted to 206,470 short tons—4 percent under the 215,848 tons reclaimed in 1948. Iron is recovered from slag either by magnetic methods or by hand picking and represents a useful contribution to the iron and steel industry.

EMPLOYMENT

In all, 2,134 plant and yard employees were reported by the slag industry in 1949 (2,087 in 1948). The total number of man-hours utilized in 1949 was 5,169,000 compared with 5,419,000 in 1948.

TECHNOLOGY

The continued use of expanded slag as a lightweight aggregate focused attention on new plants and methods in 1949. A modern plant of the Lone Star Steel Co., Lone Star, Tex., began manufacturing expanded slag aggregate in June 1949. This product is produced and marketed under license of the Celotex Corp., Chicago. According to a description of the process, a Caldwell B machine with a capacity of about 50 tons per hour is directly connected with a slag chute at the discharge end of the furnace. The machine uses rotor-type expansion with water-cooled side plates, table, and cone.[3]

A method and apparatus for the production of expanded slag has been issued under United States Patent 2,450,978. In the process the molten slag is broken up and expanded by a water jet and then impelled by additional jets against a baffle so adjusted as to deflect the path of the slag pellets causing them to become fused together while in a plastic condition.[4]

[3] Pit and Quarry, vol. 42, No. 3, September 1949, pp. 88–90. Rock Products, vol. 52, No. 10, October 1949, pp. 154–155.
[4] Journal of the American Ceramic Soc., vol. 32, No. 4, Apr. 1, 1949, p. 106.

Announcement has been made that the Steelton Foam Slag Corp. plans to enter the lightweight slag field. Production of expanded slag was scheduled to start in May 1949.[5]

United States Patent 2,444,361, covering the fabrication of refractory hot-tops, tiles, and structural shapes, has been issued. According to a brief description of the process the mixture of blast-furnace slag (40–55 percent) and fire-clay (45–60 percent) is more easily extruded through dies, is lighter in weight, and shows less tendency to crack during the burning operation than when fabricated with clay alone.[6]

As stated in the 1948 chapter, dust in slag plants has long been a problem. In this connection, the Pennsylvania State Health Department made a survey of atmospheric conditions at plants of the Duquesne Slag Products Co., Pittsburgh, Pa. Samples were collected with midget impingers and standard Greenberg-Smith impingers, and dust counts, particle-size determinations, and chemical analyses were made. It was found that none of the dust samples exceeded the maximum allowable concentration of 50 million particles per cubic foot of air, which is the limit for dust containing less than 5 percent of free silica.[7]

During the year the slag industry agreed to conduct a safety contest, under supervision of the Federal Bureau of Mines, to promote safety among its employees. In all, 42 slag plants enrolled in the contest.

Investigations are underway by the Mont Coal Mines of Armco regarding the use of finely ground slag as a traction sanding medium in coal mines. The slag is intended to replace silica sand on account of the silicosis hazard. In addition, experiments are now underway involving both air-cooled and granulated slag by various groups on this promising use of slag.[8]

The application of granulated slag to construction of bases for either rigid or flexible-type highway pavements has been further advanced by engineers of the Ohio State Highway Department, using Vibro-Tamper compaction machines.[9]

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[5] Pit and Quarry, vol. 41, No. 11, May 1949, p. 75.
[6] British Abstracts, BI, July 1949, p. 685.
[7] Work cited in footnote 2.
[8] Mining Engineer, vol. 187, No. 1, January 1950, p. 19.
[9] Slag Runner, vol. 2, No. 2, Apr. 15, 1950, p. 100.

Slate

By D. G. Runner and M. G. Downey

GENERAL SUMMARY

THE DOMESTIC output of slate during 1949 fell below the production reported in the preceding year. Sales in the roofing-slate portion of the industry, although lower than in 1948, constituted more than half the dollar value of the dimension-stone group and were well above the low record of 1944 and the intervening years. The average value per square in 1949 was $20.71, off 17 cents from the 1948 average. In the principal roofing-slate-producing centers, only Virginia gained in sales of this commodity. Sales in other areas—notably Pennsylvania, New York, Vermont, and Maine—declined from the previous year, according to reports from producers.

In contrast with the roofing-slate industry, production of mill stock exceeded the output in 1948. Sales amounting to $1,727,649 (about one-fourth of the total value of dimension stone) were 8 percent over 1948. Declines in production ranged from 9 percent for school slates to 37 percent for grave vaults and covers. With the exception of school slates, blackboards and bulletin boards, and structural and sanitary slate, values were below 1948 levels. The output of structural and sanitary slate and of blackboards and bulletin boards exceeded the 1948 totals both quantitywise and in dollar value, amounting to as much as 35 percent (value) in the case of structural and sanitary slate.

Flagstones, including slate employed for walkways, stepping stones, and miscellaneous uses trended upward, and the value of sales increased 30 percent over the preceding year.

Slate granules are used in making roofing materials that compete in the roofing-slate market. However, most of the slate consumed in the manufacture of granules and flour is unsuited for other slate products. Sales of granules and flour declined slightly from the previous year's totals. With the exception of 1946–48, inclusive, production was the greatest since the industry started, while the unit value ($9.48 per short ton) reached a record high. Figures for sales of granules of all types, including slate, are presented in the Stone chapter of this volume.

Salient statistics of the slate industry in the United States, 1948–49

	1948			1949			Percent of change in—	
	Quantity		Value	Quantity		Value	Quantity (unit as reported)	Value
	Unit of measurement	Approximate equivalent short tons		Unit of measurement	Approximate equivalent short tons			
Domestic production (sales by producers):	*Squares*			*Squares*				
Roofing slate	218, 650	82, 090	$4, 566, 056	181, 490	68, 260	$3, 759, 564	−17	−18
Mill stock:	*Sq. ft.*			*Sq. ft.*				
Electrical slate	373, 250	2, 800	451, 459	242, 700	1, 760	323, 574	−35	−28
Structural and sanitary slate	618, 810	5, 120	465, 386	806, 790	6, 390	627, 936	+30	+35
Grave vaults and covers	24, 460	210	16, 292	15, 460	140	12, 687	−37	−22
Blackboards and bulletin boards	928, 340	2, 020	535, 254	1, 145, 080	2, 840	649, 451	+23	+21
Billiard-table tops	193, 450	1, 430	118, 592	164, 100	1, 200	100, 203	−15	−16
School slates	[1] 402, 940	370	13, 036	[1] 366, 910	400	13, 798	−9	+6
Total mill stock	2, 541, 250	11, 950	1, 600, 019	2, 741, 040	12, 730	1, 727, 649	+8	+8
Flagstones, etc.[2]	6, 712, 920	46, 490	700, 477	7, 945, 120	51, 000	912, 503	+18	+30
Total slate as dimension stone		140, 530	6, 866, 552		131, 990	6, 399, 716	−6	−7
Granules and flour		658, 870	6, 014, 377		608, 270	5, 764, 560	−8	−4
Grand total domestic production		799, 400	12, 880, 929		740, 260	12, 164, 276	−7	−6

[1] Square feet approximate. Number of pieces: 1948, 751,760; 1949, 682,270.
[2] Includes slate used for walkways, stepping stones, and miscellaneous uses.

SALES

Dimension Slate.—Blocks or slabs cut to specified sizes and shapes are normally classed as "dimension slate"; this class includes all slate products except granules and flour. The following table shows sales of dimension slate for the latest 5-year period.

As roofing slate is used chiefly in residential building, comparison of roofing-slate sales with the number of new dwelling units highlights a rather interesting trend. The relationship between these items for

Dimension slate sold by producers in the United States, 1945–49

Year	Roofing			Mill stock		Other[1]		Total	
	Squares	Approximate equivalent short tons	Value	Approximate short tons	Value	Approximate short tons	Value	Approximate short tons	Value
1945	101, 300	38, 240	$976, 122	11, 520	$742, 345	19, 900	$253, 273	69, 660	$1, 971, 740
1946	146, 790	56, 240	1, 982, 928	12, 150	1, 032, 584	27, 860	403, 990	96, 250	3, 419, 502
1947	170, 590	64, 350	3, 094, 780	13, 550	1, 444, 835	34, 610	537, 705	112, 510	5, 077, 320
1948	218, 650	82, 090	4, 566, 056	11, 950	1, 600, 019	46, 490	700, 477	140, 530	6, 866, 552
1949	181, 490	68, 260	3, 759, 564	12, 730	1, 727, 649	51, 000	912, 503	131, 990	6, 399, 716

[1] Includes flagstones, walkways, stepping stones, and miscellaneous slate.

the period 1925 to 1949 is shown in figure 1. From 1929 to 1938, sales of roofing slate closely parallelled the normally expected requirements of the small building programs in those years. However, since 1938, sales of roofing slate have not paced the number of new dwelling units constructed. Factors influencing this situation are the inroads made by prepared roofing materials and the number of lower-priced houses for which slate is not commonly used.

Mill-stock slate is used extensively for equipment in nonresidential types of buildings, and in general its sales more or less parallel construction activity in this field from about 1929 to approximately 1939. From this point on, sales of mill stock fail to correlate with construction activity. The relationships for 1925 to 1949 are indicated in figure 1.

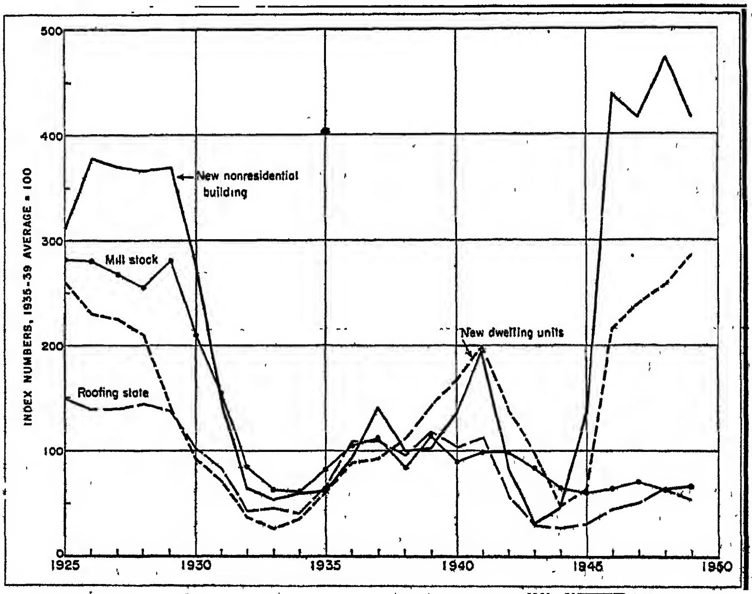

FIGURE 1.—Sales of roofing slate and mill stock compared with number of new dwelling units and value of new nonresidential construction, 1925–49. Data on number of new dwelling units (actual starts) in nonfarm areas from U. S. Department of Labor; on value of nonresidential construction activity from U. S. Department of Commerce, Survey of Current Business.

Figure 2 presents a graphic summary of the value of slate sold from 1915 to 1949, by uses. It will be noted that two peaks have been reached since 1915, one in 1925 and the other in 1948. The industry declined during the depression period and to a smaller extent during World War II.

Figure 3 presents a graphical summary of slate production, by uses, on a quantity basis. As indicated in the figure, granules and flour occupy a predominant place in the industry, quantitywise as well as in value of production.

Granules and Flour.—Sales of granules, which are used chiefly in surfacing prepared roofing, declined 7 percent in quantity and 3 percent in value compared with the 1948 figures. Sales of slate

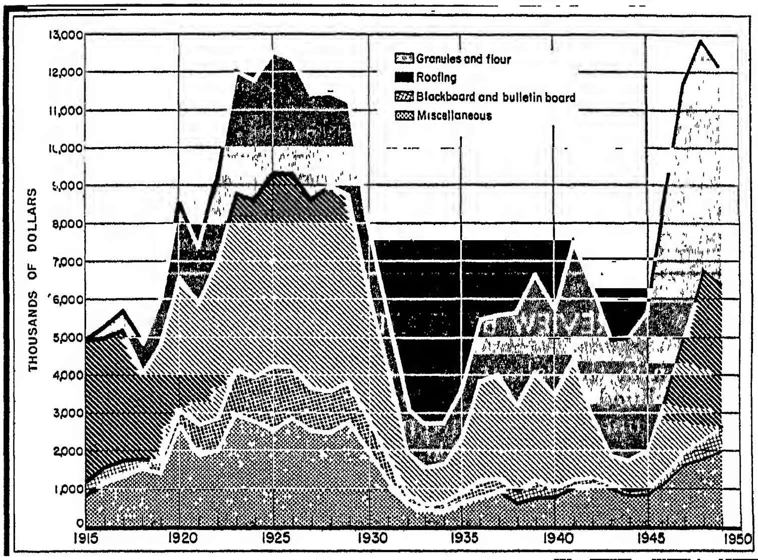

FIGURE 2.—Value of slate sold in the United States, 1915–49, by uses.

flour—a byproduct of granule manufacture and used in paints, roofing mastic, linoleum, and as a filler in road-asphalt surface mixtures—likewise declined. The decrease amounted to 9 percent quantitywise and 11 percent in value. Granules and flour were produced in Arkansas, California, Georgia, New York, Pennsylvania, and Vermont, while Maryland and Virginia produced granules only. Sales of these products for the latest 5-year period are shown in an accompanying table.

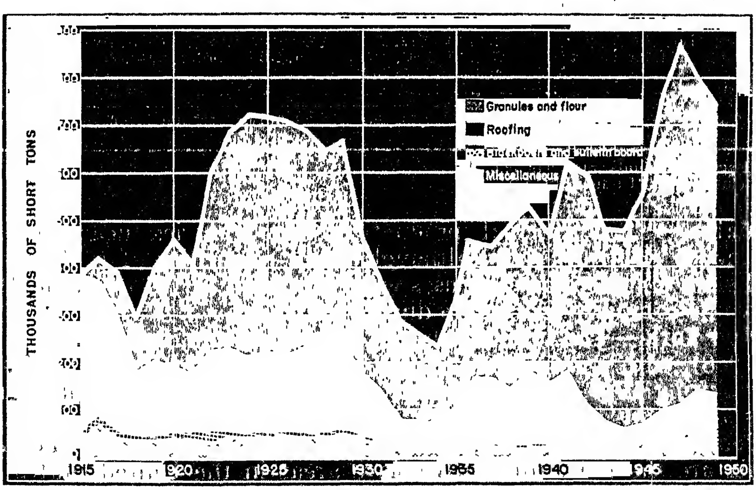

FIGURE 3.—Quantity of slate sold in the United States, 1915–49, by uses.

Crushed slate (granules and flour) sold by producers in the United States, 1945–49

Year	Granules		Flour		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	374,800	$3,299,593	107,430	$387,580	482,230	$3,687,173
1946	513,780	4,851,314	149,740	573,290	663,520	5,424,604
1947	593,560	5,911,151	169,940	697,083	763,500	6,608,234
1948	499,440	5,306,568	159,430	707,809	658,870	6,014,377
1949	463,290	5,136,992	144,980	627,568	608,270	5,764,560

REVIEW BY STATES AND DISTRICTS

As shown in the salient statistics table, total domestic production of slate declined 7 percent in 1949 compared with the 1948 output. A total of 80 operators reported production during the year, a decrease of 3. The accompanying table shows sales of slate in 1949, by States and uses.

Slate sold by producers in the United States, by States and uses, 1945–49

	Operators	Roofing		Mill stock		Other uses (value) [1]	Total value
		Squares (100 square feet)	Value	Square feet	Value		
1945	46	101,300	$976,122	2,107,780	$742,345	$3,940,446	$5,658,913
1946	61	146,790	1,982,928	2,371,820	1,032,584	5,828,594	8,844,106
1947	76	170,590	3,094,780	2,549,080	1,444,835	7,145,939	11,685,554
1948	83	218,650	4,566,056	2,541,250	1,600,019	6,714,854	12,880,929
1949							
Arkansas	1					(2)	(2)
California	2					(2)	(2)
Georgia	1					(2)	(2)
Maryland	1					(2)	(2)
New York	16	280	12,616			1,604,481	1,617,097
Pennsylvania	26	112,870	2,124,573	2,339,830	1,243,798	1,210,273	4,578,644
Vermont and Maine	28	47,910	1,064,061	401,210	483,851	2,377,309	3,925,221
Virginia	5	20,430	558,314			(2)	(2)
Undistributed						1,485,000	2,043,314
Total	80	181,490	3,759,564	2,741,040	1,727,649	6,677,063	12,164,276

[1] Flagging and similar products, granules, and flour.
[2] Included with "Undistributed."

Maine.—The principal product of the quarries near Monson, Maine, is electrical slate, although small quantities of roofing slate and slate for miscellaneous uses were produced in 1949. As in 1948, only one company was active during the year.

New York.—The total number of slate operators increased to 16 (13 in 1948), with a resultant increase of 5 percent in the value of slate sold during 1949. The principal slate products were flagging, granules, and flour, and minor amounts of roofing slate.

Pennsylvania.—Lehigh and Northampton Counties in Pennsylvania are the most productive slate areas in the United States and furnish all types of slate products. Slate produced in York County in the Peach Bottom district, on the Maryland-Pennsylvania border

Slate sold by producers in Pennsylvania in 1949, by counties and uses

County	Operators	Roofing slate: Squares (100 square feet)	Roofing slate: Value	Mill stock: Electrical: Square feet	Mill stock: Electrical: Value	Mill stock: Structural and sanitary: Square feet	Mill stock: Structural and sanitary: Value	Mill stock: Vaults and covers: Square feet	Mill stock: Vaults and covers: Value
Lehigh	6	5,280	$102,788						
Northampton and York [1]	20	107,590	2,021,785	3,480	$3,894	645,060	$463,980	15,200	$12,472
Total: 1949	26	112,870	2,124,573	3,480	3,894	645,060	463,980	15,200	12,472
1948	26	146,860	2,846,371	37,270	31,157	518,210	371,595	24,000	15,817

County	Mill stock—Continued: Blackboards and bulletin boards: Square feet	Blackboards and bulletin boards: Value	Billiard-table tops: Square feet	Billiard-table tops: Value	School slates: Square feet	School slates: Value	Other uses (value)	Total value
Lehigh	420,640	$185,832			366,910	$13,798	$2,574	$304,992
Northampton and York [1]	724,440	463,619	164,100	$100,203			1,207,699	4,273,652
Total: 1949	1,145,080	649,451	164,100	100,203	366,910	13,798	1,210,273	4,578,644
1948	928,340	535,254	192,960	117,754	402,940	13,036	1,420,169	5,351,153

[1] York County produced granules and flour only.

between Cardiff, Md., and Delta, Pa., may not be shown separately and therefore, in the accompanying table which gives detailed figures for Pennsylvania, is included with Northampton County.

The total value of all slate products sold in Pennsylvania in 1949 dropped 14 percent from the preceding year's value. Both quantity and value of roofing slate, electrical slate, vaults and covers, and billiard-table tops, and the quantity (but not value) of school slates, and slate for miscellaneous uses (including granules and flour) decreased below the 1948 totals. On the other hand, structural and sanitary slate and blackboards and bulletin boards registered gains. The percentage changes in these items in 1949 compared with 1948 were as follows: Roofing slate, decrease of 23 percent in quantity and 25 percent in value; electrical slate, decrease of 91 percent in quantity and 88 percent in value; structural and sanitary slate, increase of 24 percent in quantity and 25 percent in value; vaults and covers, decrease of 37 percent in quantity and 21 percent in value; blackboards and bulletin boards, increase of 23 percent in quantity and 21 percent in value; billiard-table tops, decrease of 15 percent in

quantity and value; school slates, decrease of 9 percent in quantity and increase of 6 percent in value. Slate for other uses decreased 15 percent in value. Most of the slate in this producing area is a blue-black, "soft-vein" material well adapted for structural products as well as for roofing. Detailed statistics for production in Pennsylvania are given in an accompanying table.

Vermont.—In order to avoid revealing the production figures of an individual firm, Maine has been included with Vermont in the table showing slate sold in the United States by States and uses. The total value of slate products sold in 1949 by Vermont and Maine was 2 percent less than in 1948. Decreases of 12 percent and 6 percent, respectively, were registered in total sales value of roofing slate and mill stock in 1949, while the value of slate for other uses increased 4 percent.

Virginia.—The principal product of the Buckingham County quarries is a dark-gray or slightly greenish slate. In 1949, 20,430 squares of roofing slate, valued at $558,314, were produced in this district, representing increases of 18 percent in quantity and 32 percent in value over the 1948 totals. Substantial amounts of granules were produced during the year but details cannot be given because there were too few producers.

Other Districts.—Slate products, chiefly granules and flour, were produced in Montgomery County, Ark., near Glenwood; near Placerville, El Dorado County, and in Tuolumne County, Calif.; near Fairmount, Bartow County, Ga.; and at Whiteford, Harford County, Md.

PRICES

The average value of roofing slate, f. o. b. quarry or mill, as reported to the Bureau of Mines, decreased 17 cents per square to $20.71 in 1949. In Pennsylvania it was $18.82 per square, in New York $45.06, in Vermont and Maine $22.21, and in Virginia $27.33.

The average value of mill stock was 63 cents per square foot in 1949, as it was in 1948. The average value of electrical slate increased 12 cents (to $1.33), structural and sanitary slate increased 3 cents (to $0.78), grave vaults and covers increased 15 cents (to $0.82), blackboards decreased 1 cent (to $0.57), and there was no change in the value for billiard-table tops ($0.61). The average sales value of granules a short ton increased 46 cents, while flour decreased 11 cents.

Price History.—The trend of annual average value of roofing slate and mill stock compared with the wholesale prices of all building materials over a 35-year period is indicated in figure 4. From 1915 to 1920 slate prices (compared with 1935–39 base period) have been somewhat below the general average for building materials, while from 1921 to 1936 they were above the average. Fairly close agreement with the general average of building materials was maintained from 1936 to 1945, at which time a steady uptrend began in the values of roofing slate.

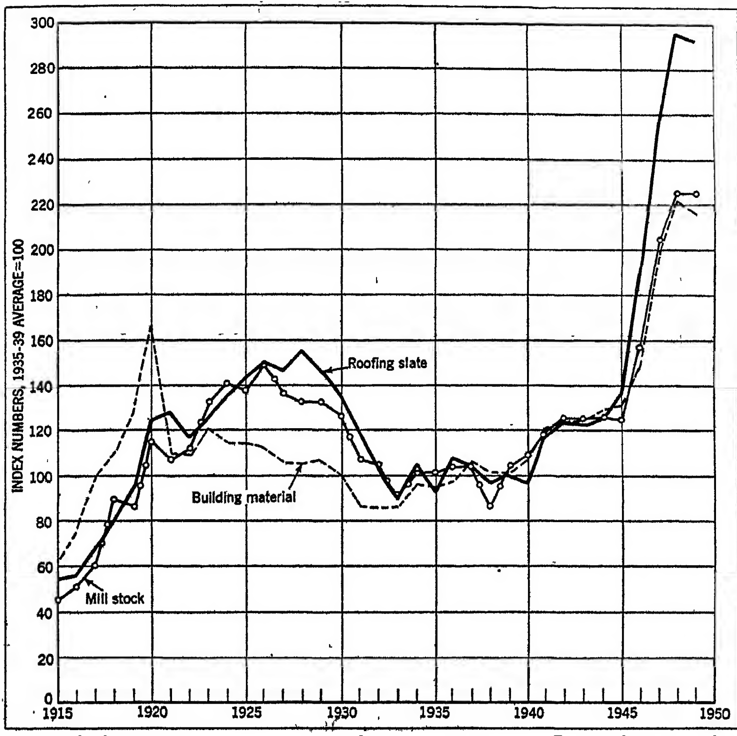

FIGURE 4.—Average value of slate compared with wholesale prices of building materials in general, 1915–49. Wholesale prices from U. S. Department of Labor.

FOREIGN TRADE

Imports.[1]—The value of slate imported for consumption has been increasing steadily since 1944, when the total was $51. In 1948 the value amounted to $13,652, while in 1949 the figure increased 52 percent to $20,753. Of this latter figure, $969 (26,622 square feet) was for roofing and $19,784 was classified as "other."

Exports.—The following tabulation gives the value of exports of slate products for the latest 5-year period as reported by shippers to the Bureau of Mines. In 1949 the total value of exports was $595,023, an increase of 1 percent.

[1] Figures on imports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Slate imported for consumption in the United States, by countries, 1944–49 [1]

[U. S. Department of Commerce]

Country	1944	1946	1947	1948	1949
Canada		$23	$16	$1,078	$1,125
China			39	66	9
Italy		83	5,688	11,584	17,589
Japan				89	51
Mexico	$50	64			
Norway				10	
Portugal		446		317	1,549
Spain				424	
Switzerland				31	406
United Kingdom	1		4	53	24
Total	51	616	5,747	13,652	20,753

[1] No imports during 1945.

Slate exported from the United States, 1945–49, by uses [1]

Use	1945	1946	1947	1948	1949
Roofing	$3,465	$7,103	$13,748	$4,476	$9,503
School slates [2]	4,751	21,701	30,436	25,846	16,601
Electrical	2,490	5,117	3,164	4,245	10,151
Blackboards	20,211	40,294	47,899	65,314	65,052
Billiard tables	161,439	47,605	43,161	58,692	79,687
Structural (including floors and walkways)	2,316	386,642	466,736	428,755	414,029
Slate granules and flour	219,933				
Total	414,605	508,462	605,144	587,328	595,023

[1] Figures collected by the Bureau of Mines from shippers of products named.
[2] Includes slate used for pencils and educational toys.

TECHNOLOGY

The growing use of lightweight aggregates in the construction industry continues to be of considerable interest. Lightweight aggregate is produced from a slate deposit near Richmond, Va.[2] United States Patent 2,456,207 covers the production of lightweight aggregate utilizing unpulverized slate particles. A report in which the properties of expanded slate when used in concrete are discussed has recently been released.[3]

UNITED KINGDOM

A recent report describes experience in diamond-sawing the green slate in Westmorland, Cumberland, and Lancashire areas, England. The article states that the slate found in these counties is much harder than Welsh slate rock and illustrates the benefits to be found in diamond-sawing the larger blocks to slate size.[4]

A factory designed to produce floor tiles is to be opened at Portmadoc, Wales. It is planned to use slate dust from Welsh quarries.[5] An article describing the Dinorwic slate operation also has been released.[6]

[2] Rock Products, vol. 52, No. 7, July 1949, pp. 101–103, 116.
[3] Division of Standardized Building Codes and Materials, Housing and Home Finance Agency, Lightweight Aggregate Concretes: August 1949, 28 pp.
[4] Industrial Diamond Review, vol. 9, No. 108, November 1949, pp. 326–330.
[5] Chemical Age (London), vol. 60, No. 1552, Apr. 9, 1949, p. 531.
[6] Mine & Quarry Engineering, vol. 15, No. 12, December 1949, pp. 371–377.

Stone

By D. G. Runner and Nan C. Jensen

GENERAL SUMMARY

COMBINED sales of dimension and crushed stone in 1949 declined slightly from the output of 225,535,390 short tons in 1948. Although production was down during the year, the total value—$341,441,645—was 4 percent greater than in 1948. The production of dimension stone declined 3 percent, but the value was up 8 percent, while the sales of crushed and broken stone decreased 1 percent quantitywise but rose 3 percent in value compared with 1948. The average unit values for all classes of dimension stone increased over 1948 figures.

In the crushed- and broken-stone industry, average values of riprap, stone for asphalt filler, and stone for use in paper mills decreased; stone for railroad ballast maintained the 1948 average value, while all other uses followed an uptrend.

The tables in this chapter give the quantities sold or used by producers and the values f. o. b. quarries and mills. Stone quarried and used by producers is considered sold and is, therefore, included with sales in the statistics. The data, however, do not include stone made into abrasives, such as grindstones, or that material used in making lime and cement. These materials are reported in terms of finished products in the Abrasive Materials, Lime, and Cement chapters of this volume. This chapter follows the general plan introduced in 1938, whereby dimension stone and crushed stone are considered separately, except in the introductory tables. The following tables show the total sales of stone by kinds, uses, and States.

Stone sold or used by producers in the United States, 1945–49, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	7,740,030	$17,052,764	14,910,540	$17,532,775	171,230	$5,284,827	112,574,420	$121,441,509
1946	11,119,490	29,492,076	16,400,120	20,683,202	205,260	7,919,979	134,717,410	155,649,197
1947	12,443,320	34,123,460	19,616,020	25,755,314	227,880	10,252,522	150,408,820	186,548,286
1948	13,685,880	38,807,266	20,654,580	29,916,965	276,000	10,421,254	166,742,390	215,451,016
1949	16,944,050	42,566,336	21,386,260	30,486,257	239,440	12,292,822	163,746,260	222,513,012

Year	Sandstone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	4,386,990	$8,712,045	13,622,000	$9,283,982	153,405,210	$179,307,902
1946	4,253,860	11,407,302	12,156,220	9,187,730	178,852,360	234,339,486
1947	6,809,080	16,586,504	18,049,670	16,078,396	207,554,790	289,344,482
1948	7,289,950	18,048,947	16,886,590	16,339,123	225,535,390	328,984,571
1949	6,954,660	19,906,326	14,755,900	13,676,892	224,026,570	341,441,645

[1] Includes mica schist, conglomerate, argillite, various light-color volcanic rocks, serpentine not used as marble, soapstone sold as dimension stone, etc.

Stone sold or used by producers in the United States, 1948–49, by uses

Use	1948		1949	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rough construction...short tons..	[1] 213,280	[1] $771,131	126,600	$603,115
Cut stone, slabs, and mill blocks [2]...cubic feet..	[1] 10,118,050	[1] 24,138,012	10,367,050	29,307,324
Approximate equivalent in short tons...	[1] 767,920	....	789,470	....
Rubble...short tons..	276,200	573,713	338,980	709,176
Monumental stone...cubic feet..	3,724,250	20,541,071	3,125,300	18,757,859
Approximate equivalent in short tons...	306,770	....	257,510	....
Paving blocks...number..	392,110	32,810	275,570	27,384
Approximate equivalent in short tons...	3,210	....	1,960	....
Curbing...cubic feet..	769,300	1,382,278	738,250	1,689,043
Approximate equivalent in short tons...	62,950	....	59,420	....
Flagging...cubic feet..	520,420	585,104	555,950	652,224
Approximate equivalent in short tons...	41,280	....	44,490	....
Total dimension stone (quantities approximate, in short tons)...	1,671,610	48,024,119	1,618,430	51,746,125
Crushed and broken stone:				
Riprap...short tons..	5,707,410	7,553,156	7,568,390	9,829,626
Crushed stone...do....	139,723,160	166,195,528	141,421,390	173,734,791
Furnace flux (limestone)...do....	34,901,940	34,250,008	30,338,300	31,874,319
Refractory stone [3]...do....	2,557,050	6,531,084	2,386,350	6,327,048
Agricultural (limestone)...do....	20,941,530	32,034,698	21,482,910	33,251,141
Other uses...do....	20,032,690	34,395,978	19,210,800	34,678,595
Total crushed and broken stone...do....	223,863,780	280,960,452	222,408,140	289,695,520
Grand total (quantities approximate, in short tons)...	225,535,390	328,984,571	224,026,570	341,441,645

[1] Revised figure.
[2] To avoid disclosure of individual outputs, dimension stone for refractory use is included with building stone. Sawed building stone includes—1948: 224,060 cubic feet (16,360 short tons) of stone for refractory use valued at $465,528; 1949: 241,610 cubic feet (17,615 tons), $524,666.
[3] Ganister (sandstone), mica schist, soapstone, and dolomite.

Stone sold or used by noncommercial producers in the United States, 1948–49, by uses

[Included in total production]

Use	1948		1949	
	Short tons	Value	Short tons	Value
Building stone...	19,270	$51,882	11,160	$56,159
Rubble...	85,330	93,900	97,510	143,987
Riprap...	1,337,260	1,467,397	3,087,220	4,085,339
Crushed stone...	13,512,810	16,924,108	13,272,820	16,862,909
Agricultural (limestone)...	330,180	461,047	465,590	715,519
Other uses...	1,277,010	1,133,329	1,971,930	1,955,125
Total...	16,561,860	20,131,663	18,906,230	23,819,038

Stone sold or used by producers in the United States, 1948–49, by States

State	1948		1949	
	Short tons	Value	Short tons	Value
Alabama	2,475,530	$4,482,133	2,636,930	$6,039,867
Arizona	307,570	263,157	356,050	203,295
Arkansas	1,379,410	1,883,500	[1] 1,279,250	[1] 2,247,236
California	[1] 11,936,240	[1] 13,155,454	11,373,700	12,594,048
Colorado	2,195,250	2,490,449	[1] 1,816,790	[1] 2,803,538
Connecticut	1,525,490	2,283,298	1,695,650	2,460,547
Delaware	36,390	89,970	37,240	92,100
Florida	[1] 4,154,920	[1] 5,115,974	4,215,090	4,748,253
Georgia	3,631,430	10,801,355	[1] 4,156,220	[1] 8,427,627
Idaho	1,081,060	1,003,858	1,440,680	1,878,801
Illinois	[1] 18,533,290	[1] 22,823,138	17,054,110	20,682,162
Indiana	[1] 6,574,390	[1] 14,989,239	[1] 6,332,360	[1] 15,227,818
Iowa	6,387,620	8,332,682	6,831,190	8,663,201
Kansas	5,315,680	5,481,190	[1] 5,978,420	[1] 7,951,490
Kentucky	6,154,950	7,598,309	7,100,160	8,586,402
Louisiana	(2)	(2)	(2)	(2)
Maine	288,760	2,021,035	258,810	2,025,870
Maryland	1,874,270	3,115,196	[1] 1,789,830	[1] 3,036,410
Massachusetts	[1] 2,367,140	[1] 6,592,952	2,290,940	6,552,935
Michigan	[1] 19,704,150	[1] 14,620,527	16,546,670	13,387,334
Minnesota	1,804,960	5,090,652	1,878,910	5,278,716
Mississippi	24,330	27,980	(2)	(2)
Missouri	[1] 9,020,580	[1] 12,820,220	9,562,720	13,909,008
Montana	614,950	613,024	[1] 602,890	[1] 563,465
Nebraska	366,110	707,327	[1] 504,870	[1] 840,758
Nevada	554,880	680,957	518,510	668,960
New Hampshire	88,430	314,353	6,910	381,141
New Jersey	3,591,440	6,375,877	4,070,790	7,896,619
New Mexico	531,300	293,858	138,290	106,135
New York	12,687,970	17,261,486	13,022,070	18,160,387
North Carolina	5,237,050	7,713,859	6,225,290	10,077,976
North Dakota	(2)	(2)	(2)	(2)
Ohio	20,275,570	27,552,017	[1] 19,364,230	[1] 27,419,158
Oklahoma	4,927,630	4,141,379	4,341,930	4,027,409
Oregon	3,682,420	5,733,658	[1] 4,397,390	[1] 6,479,164
Pennsylvania	23,172,190	35,189,148	21,226,480	34,855,664
Rhode Island	107,080	536,651	[1] 74,670	[1] 451,029
South Carolina	2,443,750	4,543,436	[1] 2,440,540	[1] 3,628,596
South Dakota	763,080	3,911,236	[1] 1,023,710	[1] 4,473,432
Tennessee	8,011,360	12,932,537	[1] 7,613,530	[1] 13,026,948
Texas	[1] 3,844,350	[1] 4,658,720	4,158,430	5,289,647
Utah	279,660	477,654	283,020	427,418
Vermont	395,380	7,992,144	441,770	8,276,287
Virginia	7,366,520	12,157,241	7,509,740	12,442,765
Washington	5,229,500	6,382,462	[1] 3,688,890	[1] 4,105,516
West Virginia	4,929,910	5,802,683	4,854,590	6,960,191
Wisconsin	[1] 7,224,330	[1] 12,581,046	7,326,710	13,636,020
Wyoming	964,460	1,265,694	1,802,580	2,227,096
Undistributed	1,313,170	2,259,507	2,279,200	6,163,877
Total	224,474,900	326,660,222	222,548,750	339,442,316
Alaska, Hawaii, Puerto Rico	1,060,490	2,324,349	1,477,820	1,999,329
Grand total	225,535,390	328,984,571	224,026,570	341,441,645

[1] To avoid disclosing confidential information certain State totals are incomplete, the figures not included being combined with "Undistributed." The class of stone omitted from such State totals is noted in the State tables in the Statistical Summary chapter of this volume.
[2] Included with "Undistributed."

DIMENSION STONE

The term "dimension stone," as used in this chapter, is applied to blocks or slabs of natural stone, most of which are cut to definite shapes and sizes. The chief uses of dimension stone are for the construction of masonry walls and for memorials. On the other hand, crushed and broken stone consists of irregular fragments sized chiefly by mechanical screening methods. The principal applications of this type of material are as concrete aggregate, railroad ballast, and furnace flux, for liming the land, and for various industrial uses that have little or no relation to masonry construction.

Dimension-stone producers may be divided into three main groups upon the basis of plant operation. The first group quarries stone and sells it as rough blocks or slabs; the second group quarries stone and also manufactures it into finished products; while the third group buys sawed slabs or rough blocks of stone and manufactures them into finished products but does not operate quarries. The Bureau of Mines statistical canvass covers the first and second groups but not the third. Bureau of Mines statistics are compiled from reports of quantities and values of original sales; hence they include some material sold as rough blocks and some sold as finished products.

Total sales of dimension stone (including slate) in 1949 decreased 3 percent in quantity but increased 6 percent in value compared with 1948. Virtually all of the total figures in this chapter exclude slate, but details of this branch of the industry are given in the separate chapter on Slate of this volume.

The following table presents salient statistics for 1948 and 1949.

Dimension stone sold or used by producers in the United States, 1948–49, by kinds and uses

Kind and use	1948	1949 Total	1949 Percent of change
Granite:			
Building stone:			
Rough construction .... short tons	136,630	55,080	−60
Value	$421,178	$316,755	−25
Average per ton	$3.08	$5.75	+87
Cut stone, slabs, and mill blocks .... cubic feet	713,350	820,650	+15
Value	$3,913,426	$4,300,878	+10
Average per cubic foot	$5.49	$5.24	−5
Rubble .... short tons	109,660	85,660	−22
Value	$236,774	$204,498	−14
Monumental stone .... cubic feet	3,326,990	2,772,580	−17
Value	$16,458,601	$15,100,149	−8
Average per cubic foot	$4.95	$5.45	+10
Paving blocks .... number	392,110	275,570	−30
Value	$32,810	$27,384	−17
Curbing .... cubic feet	699,370	578,760	−17
Value	$1,259,932	$1,365,310	+8
Total:			
Quantity .... approximate short tons	639,180	485,860	−24
Value	$22,322,721	$21,314,974	−5
Basalt and related rocks (traprock):			
Building stone:			
Rough construction .... short tons	3,340	28,100	+741
Value	$16,700	$92,669	+455
Average per ton	$5.00	$3.30	−34
Rubble .... short tons	54,890	7,270	−87
Value	$60,613	$5,030	−92
Total:			
Quantity .... short tons	58,230	35,370	−39
Value	$77,313	$97,699	+26

Dimension stone sold or used by producers in the United States, 1948–49, by kinds and uses—Continued

Kind and use	1948	1949 Total	1949 Percent of change
Marble:			
Building stone (cut stone, slabs, and mill blocks)...cubic feet..	576,500	844,740	+47
Value	$5,022,973	$7,494,892	+49
Average per cubic foot	$8.71	$8.87	+2
Monumental stone...cubic feet..	397,260	352,720	−11
Value	$4,082,470	$3,657,710	−10
Average per cubic foot	$10.28	$10.37	+1
Total:			
Quantity...approximate short tons..	82,700	101,720	+23
Value	$9,105,443	$11,152,602	+22
Limestone:			
Building stone:			
Rough construction...short tons..	47,930	24,650	−49
Value	$202,819	$110,058	−46
Average per ton	$4.23	$4.46	+5
Cut stone, slabs, and mill blocks...cubic feet..	6,222,430	6,327,580	+2
Value	$10,103,934	$12,152,609	+20
Average per cubic foot	$1.62	$1.92	+19
Rubble...short tons..	86,510	174,010	+101
Value	$184,917	$307,246	+66
Flagging...cubic feet..	185,180	180,150	−3
Value	$91,196	$100,628	+10
Total:			
Quantity...approximate short tons..	607,130	679,800	+12
Value	$10,582,866	$12,670,541	+20
Sandstone:			
Building stone:			
Rough construction...short tons..	25,380	18,770	−26
Value	$130,434	$83,633	−36
Average per ton	$5.14	$4.46	−13
Cut stone, slabs, and mill blocks...cubic feet..	1,695,740	1,818,760	+7
Value	$3,357,853	$3,623,308	+8
Average per cubic foot	$1.98	$1.99	+1
Rubble...short tons..	22,320	31,080	+39
Value	$80,026	$109,024	+36
Curbing...cubic feet..	69,930	159,490	+128
Value	$122,346	$323,733	+165
Flagging...cubic feet..	321,640	348,690	+8
Value	$477,165	$520,760	+9
Total:			
Quantity...approximate short tons..	204,250	225,590	+10
Value	$4,167,824	$4,660,458	+12
Miscellaneous stone: [1]			
Building stone...cubic feet..	910,030	555,320	−39
Value	$1,739,826	$1,785,637	
Average per cubic foot	$1.91	$3.13	+64
Rubble...short tons..	2,820	40,960	+1,352
Value	$11,383	$83,378	+632
Flagging...cubic feet..	13,600	27,110	+99
Value	$16,743	$30,836	+84
Total:			
Quantity...approximate short tons..	80,120	90,090	+12
Value	$1,767,952	$1,849,851	+5
Total dimension stone, excluding slate:			
Quantity...approximate short tons..	1,671,610	1,618,430	−3
Value	$48,024,119	$51,746,125	+8
Slate as dimension stone [2]...approximate short tons..	140,530	131,990	−6
Value	$6,866,552	$6,399,716	−7
Total dimension stone, including slate:			
Quantity...approximate short tons..	1,812,140	1,750,420	−3
Value	$54,890,671	$58,145,841	+6

[1] Includes soapstone, mica schist, volcanic rocks, argillite, and other varieties that cannot be classified in the principal groups.
[2] Details of production, by uses, are given in the Slate chapter of this volume.

BUILDING STONE

The use of stone as construction material has always occupied an important place in the building of nonresidential edifices. Continued building activity in 1949 resulted in an output of 11,890,440 cubic feet of stone—a decrease of 6 percent quantitywise but an increase of 20 percent in value compared with 1948 totals.

Building stone sold or used by producers in the United States in 1949, by kinds

Kind	Rough			
	Construction		Architectural	
	Cubic feet	Value	Cubic feet	Value
Granite	663,470	$316,755	280,360	$510,221
Basalt	327,660	92,669		
Marble			325,760	1,140,528
Limestone	293,420	110,058	2,292,240	2,235,315
Sandstone	238,840	83,633	703,440	908,612
Miscellaneous				
Total	1,523,390	603,115	3,601,800	4,794,676

Kind	Finished				Total	
	Sawed		Cut			
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
Granite [1]	322,300	$1,450,476	217,990	$2,340,181	1,484,120	$4,617,633
Basalt					327,660	92,669
Marble	134,680	891,713	384,300	5,462,651	844,740	7,494,892
Limestone	2,669,840	3,716,444	1,365,500	6,200,850	6,621,000	12,262,667
Sandstone	997,920	2,006,442	117,400	708,254	2,057,600	3,706,941
Miscellaneous	[2] 555,320	[2] 1,735,637			555,320	1,735,637
Total	[2] 4,680,060	[2] 9,800,712	2,085,190	14,711,936	11,890,440	29,910,439

[1] Sawed stone corresponds to dressed stone for construction work (walls, foundations, bridges) and cut stone to architectural stone for high-class buildings.
[2] Rough and cut miscellaneous stone included with sawed stone.

GRANITE

Sales of granite in the form of blocks and slabs declined 24 percent in quantity and 5 percent in value compared with 1948. Except for rough architectural, all unit values were greater than those for 1948. In the building-stone branch of the industry, sales of rough architectural stone gained 69 percent in quantity and 67 percent in value, and dressed stone increased 5 percent in value over 1948. Stone for rough construction and rubble declined not only in quantity but in value as well, while dressed stone decreased in quantity. Dressed monumental stone decreased slightly in quantity but increased 4 percent in value, while rough monumental stone decreased both in quantity and value compared with 1948. In 1949 the value of curbing increased slightly, but quantity decreased, while both the output and value of paving blocks declined from 1948 levels.

Granite (dimension stone) sold or used by producers in the United States in 1949, by States and uses

State	Active plants	Building: Rough: Construction: Short tons	Building: Rough: Construction: Value	Building: Rough: Architectural: Cubic feet	Building: Rough: Architectural: Value	Building: Dressed: Cubic feet	Building: Dressed: Value	Rubble: Short tons	Rubble: Value	Monumental: Rough: Cubic feet	Monumental: Rough: Value	Monumental: Dressed: Cubic feet	Monumental: Dressed: Value	Paving blocks: Number	Paving blocks: Value	Curbing: Cubic feet	Curbing: Value	Total: Short tons (approximate)	Total: Value
Alaska	1							(1)	(1)									(1)	(1)
California	14	500	$2,150	2,000	$9,000	(1)	(1)	1,550	$1,730	25,490	$92,275	(1)	(1)			(1)	(1)	5,480	$250,175
Colorado	7	(1)	(1)					(1)	(1)	3,100	9,300	(1)	(1)					1,240	61,615
Connecticut	4	1,690	9,625	(1)	(1)	(1)	(1)	4,780	14,179	(1)	(1)	(1)	(1)			5,410	$11,133	9,640	138,290
Georgia	13					(1)	(1)	(1)	(1)	630,700	1,510,936	128,470	$1,125,888	(1)	(1)	(1)	(1)	85,910	2,816,057
Maine	7			84,500	113,024	97,800	$946,906	1,520	5,797	8,010	20,999	18,130	190,703	(1)	(1)	(1)	(1)	21,890	1,342,441
Maryland	4	(1)	(1)					(1)	(1)							(1)	(1)	(1)	(1)
Massachusetts	6	(1)	(1)	126,110	295,428	237,460	1,047,578	(1)	(1)	13,720	63,213	(1)	(1)	(1)	(1)	(1)	(1)	75,890	3,073,878
Minnesota	17			(1)	(1)	(1)	(1)			91,800	219,688	(1)	(1)					23,370	2,331,025
Missouri	2							570	4,030	32,490	104,095	10,230	66,012					4,140	174,137
Montana	3									(1)	(1)	(1)	(1)					70	2,218
New Hampshire	3	(1)	(1)			(1)	(1)	710	2,316	(1)	(1)	2,300	10,300					3,970	376,766
New York	2			16,000	26,000	22,430	95,000	1,430	5,500					(1)	(1)	450	900	(1)	(1)
North Carolina	5	(1)	(1)			(1)	(1)	(1)	(1)	37,110	119,443	(1)	(1)	23,100	$3,390	(1)	(1)	20,790	1,000,184
Oklahoma	6	(1)	(1)	2,430	9,113			(1)	(1)	(1)	(1)	45,340	546,696			(1)	(1)	4,720	569,170
Oregon	1											(1)	(1)					(1)	(1)
Pennsylvania	7	25,930	102,000	35,720	25,000	150	1,694	(1)	(1)	310	1,566	(1)	(1)			590	650	33,820	266,426
Puerto Rico	1							(1)	(1)									(1)	(1)
Rhode Island	2									42,540	267,513							3,470	267,513
South Carolina	3	3,770	16,956							(1)	(1)	(1)	(1)			(1)	(1)	11,740	330,388
South Dakota	9			(1)	(1)	(1)	(1)			(1)	(1)	178,410	2,226,154					23,740	2,720,835
Texas	2									(1)	(1)							(1)	(1)
Vermont	6			(1)	(1)	(1)	(1)			894,000	3,544,753	(1)	(1)					72,820	3,553,073
Virginia	2	(1)	(1)			(1)	(1)					(1)	(1)					(1)	(1)
Washington	3			(1)	(1)			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)	560	21,653
Wisconsin	9					(1)	(1)	(1)	(1)	24,930	77,764	105,630	1,406,031	(1)	(1)			11,260	1,530,682
Undistributed		23,190	186,024	14,600	32,656	182,450	1,699,479	75,100	170,946	215,820	669,973	264,050	2,826,847	252,470	23,994	572,310	1,352,627	71,340	488,448
Total	139	55,080	316,765	280,880	510,221	540,290	3,790,657	85,660	204,498	2,020,020	6,701,518	752,560	8,398,631	275,570	27,384	578,760	1,365,310	485,860	21,314,974
Averge unit value			$5.75		$1.82		$7.02		$2.39		$3.32		$11.16		$0.10		$2.36		$43.87
Short tons (approximate)		(2)		23,220		44,610				165,530		62,000		1,960		47,800			

[1] Included with "Undistributed."
[2] 663,470 cubic feet (approximate).

The following tables show sales of monumental granite in the Barre district, Vermont. These figures exclude small quantities of Barre granite sold as construction or crushed stone.

Monumental granite sold by quarrymen in the Barre district, Vermont, 1940–49

Year	Cubic feet	Value	Year	Cubic feet	Value
1940	601,190	$2,039,960	1945	713,050	$2,308,506
1941	764,280	2,431,152	1946	990,160	3,461,801
1942	612,220	2,035,327	1947	937,400	3,534,798
1943	635,350	2,267,777	1948	1,039,580	3,952,622
1944	733,500	2,553,681	1949	890,080	3,528,756

Estimated output of monumental granite in the Barre district, Vermont, 1947–49

[Barre Granite Association, Inc.]

	1947	1948	1949
Total quarry output, rough stock...cubic feet	927,046	1,043,958	894,240
Shipped out of Barre district in rough...do	185,409	208,792	178,848
Manufactured in Barre district...do	741,637	835,166	715,392
Light stock consumed in district...do	494,424	556,778	596,160
Dark stock consumed in district...do	247,213	278,388	298,080
Number of cutters in district	1,748	1,748	1,748
Average daily wage	$12.50	$12.50	$13.50
Average number of days worked	186	252	248
Total pay roll for year	$4,064,100	$5,506,200	$5,852,304
Estimated overhead	2,032,050	2,753,100	2,926,152
Estimated value of light stock	2,688,430	2,421,984	2,950,892
Estimated value of dark stock	1,606,878	1,447,618	1,550,016
Estimated polishing cost	1,865,681	2,099,965	1,799,658
Estimated sawing cost	1,460,098	1,644,234	1,408,428
Total value of granite	13,717,237	15,873,101	16,487,450

BASALT AND RELATED ROCKS (TRAPROCK)

Owing to their dark color, basalt and related rocks are not used extensively as building stone. Total sales in 1949 decreased 39 percent in quantity but increased 26 percent in value. Sales of basalt in 1949 for rough construction were greater than in 1948; but output for rubble, a crude form of building stone, amounted to about one-eighth of the previous year's total. Unit values for these two types of material declined from $5.00 and $1.10 to $3.30 and $0.69, respectively. Basalt and related dark rocks are used to some extent for memorials, but such stones are normally classed in the trade as "black granite" and are therefore included with statistics for monumental granite.

Basalt and related rocks (traprock) (dimension stone) sold or used by producers in the United States in 1949, by States and uses

State	Active plants	Building stone: Rough construction: Short tons	Building stone: Rough construction: Value	Building stone: Rubble: Short tons	Building stone: Rubble: Value	Total: Short tons	Total: Value
Connecticut	1	(1)	(1)			(1)	(1)
Hawaii	2	(1)	(1)	20	$30	(1)	(1)
Oregon	2	4,740	$21,006	7,250	5,000	11,990	$26,006
Pennsylvania	1	21,070	68,210			21,070	68,210
Undistributed		2,290	3,453			2,310	3,483
Total	6	[2] 28,100	92,669	7,270	5,030	35,370	97,699
Average unit value			$3.30		$0.69		$2.76

[1] Included with "Undistributed."
[2] 327,660 cubic feet (approximate).

MARBLE

In 1949 total sales of marble increased 23 percent quantitywise and 22 percent in value compared with 1948. Marble for building stone, for both exterior and interior use, increased substantially in quantity and value over 1948, whereas sales of monumental stone decreased 11 and 10 percent in quantity and value, respectively. The average unit value for building and monumental marble increased 16 and 9 cents, respectively, to $8.87 and $10.37, whereas the total average unit value decreased 4 cents to $9.31. Details on marble, by uses and States, are shown in accompanying tables.

Marble (dimension stone) sold by producers in the United States, 1948–49, by uses

Use	1948: Cubic feet	1948: Value	1949: Cubic feet	1949: Value
Building stone:				
Rough:				
Exterior	17,930	$86,963	17,350	$69,023
Interior [1]	159,720	496,016	308,410	1,071,505
Finished:				
Exterior	82,520	713,799	165,110	1,506,872
Interior	316,330	3,726,195	353,870	4,847,492
Total exterior	100,450	800,762	182,460	1,575,895
Total interior	476,050	4,222,211	662,280	5,918,997
Total building stone	576,500	5,022,973	844,740	7,494,892
Monumental stone:				
Rough / Finished	397,260	4,082,470	352,720	3,657,710
Total monumental stone	397,260	4,082,470	352,720	3,657,710
Total building and monumental	973,760	9,105,443	1,197,460	11,152,602
Approximate short tons	82,700		101,720	

[1] Includes onyx for the manufacture of mantels, lamp bases, desk sets, clock cases, and novelties.

Marble (dimension stone) sold by producers in the United States in 1949, by States and uses

State	Active plants	Building: Cubic feet	Building: Value	Monumental: Cubic feet	Monumental: Value	Total Quantity: Cubic feet	Total Quantity: Short tons (approximate)	Total: Value
Alabama	2	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Arkansas	1	10,000	$15,000	400	$1,600	10,400	890	$16,600
Colorado	1	8,340	22,943			8,340	710	22,943
Georgia	1	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Maryland	1	8,500	80,811			8,500	720	80,811
Minnesota	1	5,500	32,500			5,500	400	32,500
Missouri	3	60,200	640,989	4,530	26,772	64,730	5,500	667,761
North Carolina	1			3,590	35,926	3,590	310	35,926
Tennessee	7	433,620	3,028,883	6,610	108,903	440,230	37,420	3,137,786
Utah	1	3,530	15,000			3,530	300	15,000
Vermont	6	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed		315,050	3,658,766	337,590	3,484,509	652,640	55,470	7,143,275
Total	25	844,740	7,494,892	352,720	3,657,710	1,197,460	101,720	11,152,602
Average unit value			$8.87		$10.37			[2] $9.31
Short tons (approximate)		71,740		29,980				

[1] Included with "Undistributed."
[2] Average value per cubic foot.

LIMESTONE

Limestone blocks cut to definite shapes and sizes are used almost exclusively for building purposes. Such material is used for interiors and exteriors of public buildings of all kinds, such as post offices, churches, museums, schools, and commercial structures. Since the war the industry has been climbing steadily in production, and 1949 was no exception. Although building stone, for both rough construction and rough architectural, declined in 1949, cut and sawed material increased sharply in quantity and value. The output of rubble doubled in quantity and increased two-thirds in value over 1948, while stone for flagging decreased slightly in quantity but gained 10 percent in value.

With the exception of rubble, all unit values increased in 1949, and the over-all average value increased from $17.43 in 1948 to $18.64 in 1949.

The area in the United States most productive of dimension limestone is in the vicinity of Bedford and Bloomington, Ind. This area supplied 78 percent of the rough architectural and finished (sawed and cut) limestone in 1949. Accompanying tables show production in the Bedford-Bloomington, Ind., and Carthage, Mo., areas over a 5-year period.

Limestone (dimension stone) sold or used by producers in the United States in 1949, by States and uses

State	Active plants	Building								Flagging		Total	
		Rough				Finished (cut and sawed)		Rubble					
		Construction		Architectural									
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Short tons (approximate)	Value
Alabama	2	(1)	(1)	(1)	(1)	(1)	(1)					(1)	(1)
California	5	230	$1,237			(1)	(1)	(1)	(1)	(1)	(1)	3,570	$50,100
Connecticut	1	90	313									90	313
Illinois	9	70	348					35,800	$57,208	24,220	$11,473	37,930	69,029
Indiana	17	200	314	1,896,780	$1,742,517	3,019,080	$6,183,565	18,850	20,559			375,450	7,946,955
Iowa	3							240	944	4,710	400	640	1,344
Kansas	13	1,200	1,843	(1)	(1)	(1)	(1)	4,680	3,901	2,650	900	23,440	362,134
Kentucky	4	(1)	(1)					(1)	(1)			790	730
Michigan	3	(1)	(1)			(1)	(1)	(1)	(1)	(1)	(1)	3,300	26,604
Minnesota	7	(1)	(1)	(1)	(1)	141,130	650,750	4,520	15,925	(1)	(1)	22,080	763,300
Missouri	12	8,400	27,674			45,850	377,966	14,470	44,748	9,700	6,775	27,590	457,163
New Mexico	1	(1)	(1)									(1)	(1)
New York	1	(1)	(1)							(1)	(1)	(1)	(1)
Ohio	2	(1)	(1)					(1)	(1)			17,650	19,750
Pennsylvania	7	4,520	15,210					(1)	(1)	(1)	(1)	31,740	87,990
Puerto Rico	2							8,330	8,934			8,330	8,934
Tennessee	3	(1)	(1)					(1)	(1)			3,040	3,066
Texas	7			129,340	152,093	180,350	654,212	14,130	15,392			36,580	821,697
Utah	1	(1)	(1)					(1)	(1)			(1)	(1)
Virginia	1							(1)	(1)			(1)	(1)
Washington	1									1,180	2,800	100	2,800
West Virginia	1	(1)	(1)									(1)	(1)
Wisconsin	18	480	3,040	83,510	148,272	176,050	400,418	21,880	36,464	107,530	59,998	51,730	708,192
Wyoming	1	(1)	(1)									(1)	(1)
Undistributed		9,460	60,079	182,610	192,433	472,880	1,590,383	51,110	103,171	30,160	18,282	35,750	1,340,440
Total	122	24,650	110,058	2,292,240	2,235,315	4,035,340	9,917,294	174,010	307,246	180,150	100,628	679,800	12,670,541
Average unit value			$4.46		$0.98		$2.46		$1.77		$0.56		$18.64
Short tons (approximate)		(2)		168,250		298,210				14,680			

[1] Included with "Undistributed."
[2] 293,420 cubic feet (approximate).

Limestone sold by producers in the Indiana oolitic limestone district, 1945–49, by classes

Year	Construction					
	Rough block		Sawed and semi-finished		Cut	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1945	955,320	$434,173	739,080	$571,799	401,330	$1,023,744
1946	1,930,710	1,143,664	1,340,930	1,411,831	453,010	1,460,305
1947	2,082,330	1,492,620	1,398,440	1,563,008	470,620	1,834,447
1948	2,328,180	1,914,559	1,974,730	2,312,829	682,480	3,205,984
1949	1,896,780	1,742,517	2,215,940	2,805,866	803,140	3,377,699

Year	Construction—Continued			Other uses		Total	
	Total						
	Cubic feet	Short tons (approximate)	Value	Short tons	Value	Short tons (approximate)	Value
1945	2,095,730	152,000	$2,029,716	24,880	$23,850	176,880	$2,053,566
1946	3,724,650	270,040	4,015,800	77,550	45,144	347,590	4,060,944
1947	3,951,390	286,480	4,890,075	90,440	306,784	376,920	5,196,859
1948	4,985,390	361,440	7,433,372	165,400	328,656	526,840	7,762,028
1949	4,915,860	356,400	7,926,082	48,320	149,753	404,720	8,075,835

Purchased Indiana limestone sold by mills in the Indiana oolitic limestone district, 1945–49, by classes

Year	Sawed and semi-finished		Cut		Total	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1945	10,840	$6,454	278,820	$798,372	289,660	$804,826
1946	42,360	44,200	590,320	1,972,265	632,680	2,016,465
1947	68,020	72,594	994,510	3,583,166	1,062,530	3,655,760
1948	357,080	491,898	845,850	3,558,754	1,202,930	4,050,652
1949	117,270	166,809	1,016,050	5,365,837	1,133,320	5,532,646

Limestone and marble sold by producers in the Carthage district, Jasper County, Mo., 1945–49, by classes

Year	Dimension stone (rough and dressed)							Other uses		Total	
	Building		Monumental		Total						
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Short tons (approximate)	Value	Short tons	Value	Short tons (approximate)	Value
1945	30,230	$211,299	14,150	$64,900	44,380	3,660	$276,199	223,160	$444,518	226,820	$720,717
1946	49,190	289,866	10,610	41,718	59,800	5,080	331,584	265,260	550,998	270,340	882,582
1947	58,220	487,799	2,980	24,357	61,200	5,200	512,156	300,680	513,273	305,880	1,025,429
1948	64,510	532,905	5,380	29,636	69,890	5,940	562,541	230,540	396,000	236,480	958,547
1949	84,810	934,036	4,530	26,772	89,340	7,590	960,808	238,250	420,833	245,840	1,381,641

SANDSTONE

The total production of sandstone in 1949 increased 10 percent in quantity and 12 percent in value compared with 1948. Stone for rough construction decreased 26 percent quantitywise and 36 percent in value, whereas the output of rough architectural stone almost doubled in quantity and value. Dressed sawed material decreased slightly in quantity but increased in value, while cut stone decreased 60 percent in quantity and 30 percent in value compared with 1948. Rubble, curbing, and flagging gained substantially in quantity and value over 1948 totals. Average unit values in 1949 decreased for rough construction and rubble and increased for all other types of sandstone.

As in previous years, Ohio was the principal producer and contributed 46 percent of the total output. Other producing States, in order of production, were Pennsylvania, Tennessee, and New York.

The accompanying table shows the sales of bluestone in 1940–49. Bluestone is a type of sandstone that splits readily into thin, uniform slabs. It is particularly well adapted for flagging but is used also for building stone and curbing. The output of bluestone in 1949 increased 21 percent in quantity and 15 percent in value compared with 1948.

Bluestone (dimension stone) sold or used in the United States, 1940–49 [1]

Year	Cubic feet	Value	Year	Cubic feet	Value
1940	256,900	$272,501	1945	109,330	$89,448
1941	284,190	252,313	1946	273,720	274,517
1942	183,470	166,787	1947	274,680	326,168
1943	99,840	92,059	1948	325,940	462,716
1944	156,160	108,732	1949	395,500	533,727

[1] New York and Pennsylvania were the only producing States.

MISCELLANEOUS STONE

Types of stone other than those included in the major groups already discussed are covered in the following table. The principal types in this classification are mica schist, argillite, light-colored volcanic rocks (such as rhyolite), soapstone, and greenstone. The quantity sold in 1949 increased 12 percent while the value increased 5 percent compared with 1948.

Sandstone (dimension stone) sold or used by producers in the United States in 1949, by States and uses

State	Active plants	Building								Rubble		Curbing		Flagging		Total	
		Rough construction		Rough architectural		Dressed											
						Sawed		Cut									
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons (approximate)	Value
Arizona	1	(1)	(1)													(1)	(1)
California	3	2,940	$17,515							30	$140					2,970	$17,655
Colorado	3	(1)	(1)	(1)	(1)					(1)	(1)			(1)	(1)	6,970	63,697
Illinois	1									(1)	(1)					(1)	(1)
Indiana	1			(1)	(1)									(1)	(1)	(1)	(1)
Kansas	1	(1)	(1)							(1)	(1)					(1)	(1)
Massachusetts	1			90	$216			640	$3,840							60	4,056
Michigan	2	(1)	(1)	(1)	(1)					(1)	(1)			(1)	(1)	(1)	(1)
Missouri	2			(1)	(1)			(1)	(1)							(1)	(1)
Nevada	1	(1)	(1)													(1)	(1)
New Jersey	1			1,040	622					50	147					130	769
New Mexico	1	(1)	(1)													(1)	(1)
New York (bluestone)	8			(1)	(1)	(1)	(1)	(1)	(1)	1,560	12,305	4,270	$7,144	107,620	$144,063	22,600	410,051
Ohio	9			124,930	170,918	960,130	$1,863,382	65,090	377,598	630	1,000	154,910	316,289	130,590	224,411	104,710	2,953,598
Oklahoma	1									(1)	(1)					(1)	(1)
Pennsylvania[2]	14	9,780	30,721	77,940	30,377					10,470	52,056	310	300	66,840	103,222	31,900	216,676
Tennessee	2			277,770	410,440	(1)	(1)							(1)	(1)	24,860	536,819
Utah	1	(1)	(1)							(1)	(1)					(1)	(1)
Virginia	1	(1)	(1)											(1)	(1)	(1)	(1)
Washington	1			46,560	106,491			15,360	184,501							4,950	290,992
West Virginia	3									5,190	23,395					5,190	23,305
Wisconsin	4	20	75					(1)	(1)	(1)	(1)			170	150	(1)	(1)
Undistributed		6,030	35,322	175,110	189,548	37,790	143,060	36,310	142,315	13,150	19,931			43,470	48,914	21,250	142,750
Total	62	18,770	83,633	703,440	908,612	997,920	2,006,442	117,400	708,254	31,080	109,024	159,490	323,733	348,690	520,760	225,590	4,660,458
Average unit value			$4.46		$1.29		$2.01		$6.03		$3.51		$2.03		$1.49		$20.66
Short tons (approximate)		(3)		54,960		72,660		8,940				11,620		27,560			

[1] Included with "Undistributed."
[2] Includes 128,020 cubic feet of bluestone (approximately 10,820 tons) valued at $123,676 sold for construction, curbing, and flagging.
[3] 238,840 cubic feet (approximate).

Miscellaneous varieties of stone (dimension stone) sold or used by producers in the United States in 1949, by States and uses

State	Active plants	Building: Rough and dressed		Building: Rubble		Flagging		Total	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alaska	2			(1)	(1)			(1)	(1)
California	3	(1)	(1)			(1)	(1)	3,440	$42,220
Colorado	1			(1)	(1)			(1)	(1)
Georgia	1	(1)	(1)					(1)	(1)
Maryland	4	5,160	$19,771	7,000	$36,058	870	$6,738	13,030	62,567
Minnesota	1			(1)	(1)			(1)	(1)
New Mexico	1			(1)	(1)			(1)	(1)
New York	1	(1)	(1)					(1)	(1)
Pennsylvania	3	30,160	125,940	30	120			30,190	126,060
Puerto Rico	1			(1)	(1)			(1)	(1)
Virginia	2	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Washington	1	(1)	(1)					(1)	(1)
Undistributed		11,560	1,589,926	33,930	47,200	1,380	24,098	43,430	1,619,004
Total	21	[2] 46,880	1,735,637	40,960	83,378	[3] 2,250	30,836	90,090	1,849,851
Average unit value			$37.02		$2.04		$13.70		$20.53

[1] Included with "Undistributed."
[2] Approximately 555,320 cubic feet.
[3] Approximately 27,110 cubic feet.

TRENDS IN USE OF DIMENSION STONE

The history of dimension-stone production by kinds, for a 34-year period, is reviewed in figure 1. Dimension stone finds little use during wartimes, as illustrated by low sales figures for 1918 and 1944. However since the low of 1944 the curve has been upward, and the current building activity points to continued expansion.

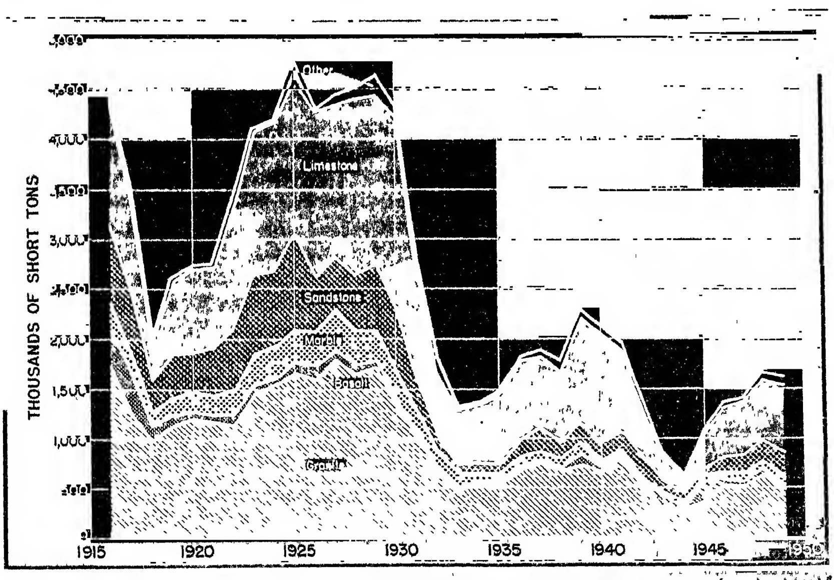

FIGURE 1.—Sales of dimension stone in the United States, by kinds, 1916–49.

Figure 2 traces for a 35-year period the history of production of all building stones and of the chief variety—limestone—in their relation to nonresidential building, the class of construction using stone most extensively. Activity in building-stone production in peacetime generally follows the trend of nonresidential construction. The industry currently is following the general trend but at a lower level.

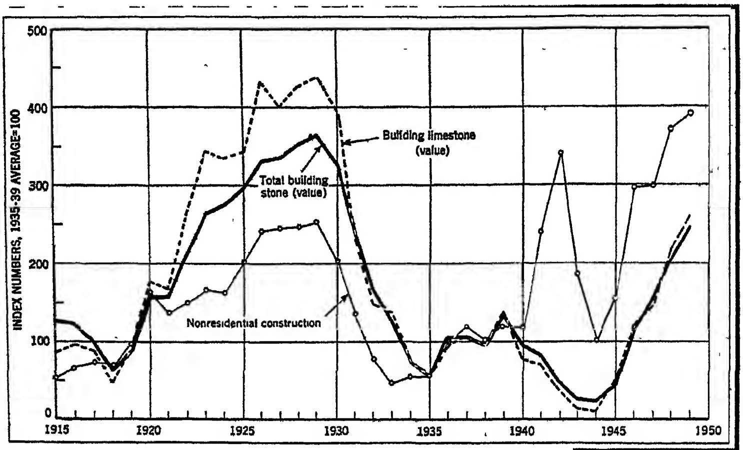

FIGURE 2.—Sales of all building stone and building limestone compared with nonresidential construction (public and private), 1915–49. Data on nonresidential-building construction from Survey of Current Business.

TECHNOLOGY

Mention was made in the 1948 Stone chapter of the stone-wall exposure panel erected at the National Bureau of Standards. It is hoped that, from a long-time study of many stone types in this wall, it will be possible to develop more reliable laboratory methods for determining or predicting durability. A recent article describes the various stones used in the test [1] wall, the waterproofing treatments, etc.

A new durability test for marble has recently been advocated. Inasmuch as marbles from different sources vary in durability, it was desirable to develop a test to determine the type of changes that occur in marbles during weathering processes. A so-called gypsum test was devised for this purpose.[2]

A thermal expansion of stone and component minerals has long provided a fertile field of research. A report on the expansion of calcite and marble has been released. Details of the expansion of these two materials, along various axes and orientations, and to temperatures up to 700° C., are presented in the article.[3]

Another item of interest to the stone industry is the development of gage and recording equipment for measuring dynamic strain in rock. The strain gage, inserted and anchored in a small-diameter diamond-drill hole, with a companion amplifier and recording camera, picks up

[1] Kessler, D. W., and Anderson, R. E., Stone-Wall Exposure Test: Stone, vol. 70, No. 4, April 1949, pp. 76–80.

[2] Kessler, D. W., A New Durability Test for Marble: Am. Soc. Test. Mat. Bull. 159, July 1949, pp. 45–49; also Stone, vol. 70, No. 10, October 1949, pp. 219–225.

[3] Rosenholtz, J. L., and Smith, D. T., Linear Thermal Expansion of Calcite, Var. Iceland Spar, and Yule Marble: Am. Mineral., vol. 34, Nos. 11–12, November–December, 1949, pp. 846–854.

and records the strain waves produced in rock by a nearby explosion.[4]

The theory has long been accepted that granite is a product of crystallization from magma. A recent report takes exception to this assumption and presents evidence that granite originated by diffusion and reaction in the solid state. Among the items mentioned in support of this concept are feldspathization of inclusions, double and reciprocal inclusions, digestion of transgressive dikes by the host rock, and microscopic evidence of replacement and corrosion.[5]

The porosity of limestone also has been made the subject of recent research.[6]

CRUSHED AND BROKEN STONE

The production of crushed and broken stone was only slightly smaller in 1949 than in 1948. The output amounted to 222,408,140 short tons, in addition to that used for making cement and lime, valued at $289,695,520—a decrease of 1 percent in tonnage but a value increase of 3 percent.

Gains were recorded in sales of concrete and road metal, riprap, agricultural stone, asphalt filler, and stone for sugar factories, whereas sales of crushed stone for other principal uses declined. The average value at the quarry increased 4 cents to $1.30 per ton.

The accompanying table of salient statistics shows the quantity sold and the value of the output during 1948 and 1949, by uses. Detailed data on asphaltic stone and slate granules and flour are given in the Asphalt and Slate chapters of this volume.

Crushed and broken stone sold or used by producers in the United States, 1948–49, by principal uses

Use	1948			1949		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Concrete and road metal	121,542,170	$149,879,694	$1.23	124,367,210	$158,357,911	$1.27
Railroad ballast	18,180,990	16,315,834	.90	17,054,180	15,376,880	.90
Metallurgical	34,901,940	34,250,008	.98	30,338,300	31,874,319	1.05
Alkali works	7,349,540	5,942,572	.81	6,022,240	5,641,705	.94
Riprap	5,707,410	7,553,156	1.32	7,568,390	9,829,626	1.30
Agricultural	20,941,580	32,034,698	1.53	21,482,910	33,251,141	1.55
Refractory (ganister, mica schist, dolomite, soapstone)	2,557,050	6,531,084	2.55	2,386,350	6,327,048	2.65
Asphalt filler	553,360	1,593,820	2.88	671,560	1,893,964	2.82
Calcium carbide works	1,052,080	1,027,952	.98	652,950	654,470	1.00
Sugar factories	471,030	1,098,933	2.33	555,030	1,361,169	2.45
Glass factories	666,360	1,410,120	2.12	621,840	1,373,314	2.21
Paper mills	475,880	908,098	1.91	417,850	766,856	1.84
Other uses	9,464,440	22,414,483	2.37	10,269,330	22,987,117	2.24
Total	223,863,780	280,960,452	1.26	222,408,140	289,695,520	1.30
Portland and natural cement and cement rock [1]	54,513,000	[2]		55,219,000	[2]	
Lime [3]	14,528,000	[2]		12,637,000	[2]	
Grand total	292,905,000	[2]		290,264,000	[2]	
Asphaltic stone	1,084,004	3,634,917	3.35	1,150,931	4,264,989	3.71
Slate granules and flour	658,870	6,014,377	9.13	608,270	5,764,560	9.48

[1] Value reported as cement in chapter on Cement.
[2] No value available for stone used in manufacture of cement and lime.
[3] Value reported as lime in chapter on Lime.

[4] Obert, L., and Duvall, W. I., A Gage and Recording Equipment for Measuring Dynamic Strain in Rock: Bureau of Mines Rept. of Investigations 4581, 1949, 11 pp.
[5] Perrin, R., and Roubault, M., On the Granite Problem: Jour. Geol., vol. 57, No. 4, July 1949, pp. 357–379.
[6] Mining Journal (London), vol. 232, No. 5926, Mar. 19, 1949, p. 208.

The following tables show the tonnage and value of stone used for concrete and road metal and railroad ballast for a series of years and by States for 1949.

Crushed stone for concrete and road metal and railroad ballast sold or used by producers in the United States, 1945–49

Year	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	64,108,190	$65,535,403	21,265,070	$14,894,216	85,373,260	$80,429,619
1946	90,358,900	97,765,446	16,908,350	13,127,058	107,267,250	110,892,504
1947	107,077,590	125,753,455	16,350,260	13,566,869	123,427,850	139,320,324
1948	121,542,170	149,879,694	18,180,990	16,315,834	139,723,160	166,195,528
1949	124,367,210	158,357,911	17,054,180	15,376,880	141,421,390	173,734,791

Crushed stone for concrete and road metal and railroad ballast sold or used by producers in the United States in 1949, by States

State	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	[1] 89,170	[1] $109,975	80	$71	[1] 89,250	[1] $110,046
Arizona	250,100	134,883			250,100	134,883
Arkansas	1,283,900	2,188,275	[1] 4,110	[1] 3,902	[1] 1,288,010	[1] 2,192,177
California	7,662,990	7,328,645	[1] 665,380	[1] 519,273	[1] 8,328,370	[1] 7,847,918
Colorado	225,730	406,973	103,890	138,616	329,620	545,589
Connecticut	1,550,450	1,999,864	57,550	63,295	1,608,000	2,063,159
Delaware	35,240	88,100			35,240	88,100
Florida	3,067,440	3,511,622	407,300	359,308	3,474,740	3,870,930
Georgia	3,152,400	4,235,313	182,860	205,056	3,335,260	4,440,369
Idaho	[1] 1,116,060	[1] 1,549,146	(2)	(2)	1,333,200	1,759,974
Illinois	[1] 9,418,920	[1] 10,763,323	727,830	700,350	[1] 10,146,750	[1] 11,463,673
Indiana	3,498,330	4,001,069	490,510	523,047	3,988,840	4,524,116
Iowa	4,711,010	5,440,695	30,270	36,469	4,741,280	5,477,164
Kansas	3,471,600	5,264,424	1,322,540	467,588	4,794,140	5,732,012
Kentucky	5,918,010	7,287,426	386,900	336,318	6,304,910	7,623,744
Maine	138,940	214,844			138,940	214,844
Maryland	[1] 1,559,200	[1] 2,335,490	[1] 21,000	[1] 27,300	1,736,550	2,625,943
Massachusetts	1,610,420	2,148,608	156,990	164,465	1,767,410	2,313,073
Michigan	2,728,480	2,407,086	(2)	(2)	[1] 2,728,480	[1] 2,407,086
Minnesota	1,080,990	1,209,346	[1] 168,550	[1] 194,168	[1] 1,249,540	[1] 1,403,514
Missouri	5,086,930	6,484,973	605,500	212,353	5,692,430	6,697,326
Montana	89,140	77,004	[1] 183,120	[1] 146,915	[1] 272,260	[1] 223,919
Nebraska	(2)	(2)			(2)	(2)
Nevada	[1] 315,260	[1] 288,637			[1] 315,260	[1] 288,637
New Hampshire	(2)	(2)	(2)	(2)	(2)	(2)
New Jersey	3,530,110	6,197,666	89,940	119,156	3,620,050	6,316,822
New Mexico			135,040	101,239	135,040	101,239
New York	[1] 9,431,810	[1] 12,807,939	972,270	1,091,979	[1] 10,404,080	[1] 13,899,918
North Carolina	5,408,210	7,864,236	480,070	634,505	5,888,280	8,498,741
Ohio	[1] 8,385,890	[1] 9,797,166	1,029,630	1,116,061	[1] 9,415,520	[1] 10,913,227
Oklahoma	[1] 1,988,040	[1] 1,970,300	[1] 1,584,110	[1] 649,790	3,724,680	2,728,473
Oregon	3,147,230	5,081,612	[1] 352,020	[1] 296,261	[1] 3,499,250	[1] 5,377,873
Pennsylvania	8,894,790	13,474,382	[1] 336,690	[1] 454,978	[1] 9,231,480	[1] 13,929,360
Rhode Island	[1] 50,000	[1] 100,000			[1] 50,000	[1] 100,000
South Carolina	[1] 1,839,390	[1] 2,661,487	383,550	472,288	[1] 2,222,940	[1] 3,133,775
South Dakota	[1] 832,320	[1] 1,506,338			[1] 832,320	[1] 1,506,338
Tennessee	5,606,190	6,845,636	657,840	633,864	6,264,030	7,479,500
Texas	[1] 2,335,120	[1] 2,716,105	443,090	354,220	[1] 2,778,210	[1] 3,070,325
Utah	[1] 92,910	[1] 34,453	(2)	(2)	157,460	111,420
Vermont	[1] 74,820	[1] 93,696	(2)	(2)	104,270	136,362
Virginia	[1] 4,200,470	[1] 5,924,283	863,690	902,688	[1] 5,064,160	[1] 6,826,971
Washington	2,670,500	2,617,022	449,140	398,309	3,119,640	3,015,331
West Virginia	[1] 1,115,390	[1] 1,737,161	432,740	402,536	[1] 1,548,130	[1] 2,139,697
Wisconsin	4,651,970	4,622,404	141,560	152,895	4,793,530	4,775,299
Wyoming	11,000	11,361	[1] 1,500,690	[1] 1,650,359	[1] 1,511,690	[1] 1,661,720
Undistributed	724,040	1,026,185	1,680,580	1,839,649	1,784,600	2,163,837
Total	123,050,910	156,565,153	17,047,030	15,369,271	140,097,940	171,934,424
Alaska, Hawaii, Puerto Rico	1,316,300	1,792,758	7,150	7,609	1,323,450	1,800,367
Grand total	124,367,210	158,357,911	17,054,180	15,376,880	141,421,390	173,734,791

[1] To avoid disclosing confidential information, total is somewhat incomplete, the figures not included being combined as "Undistributed."
[2] Included with "Undistributed."

COMMERCIAL AND NONCOMMERCIAL OPERATIONS

The accompanying table shows the production of crushed stone for concrete and road metal during recent years by Government agencies of various kinds, contrasted with that by commercial enterprises. Before 1940, Government-sponsored activities produced a substantial amount of the total output. However, the war and postwar conditions changed this situation. Consequently the output of crushed stone by noncommercial agencies dropped to 7 percent of the total production in 1945 and 1946 and has remained at 11 percent from 1947 through 1949.

Crushed stone for concrete and road metal sold or used by commercial and noncommercial operators in the United States, 1945–49

[Figures for "noncommercial operations" represent tonnages reported by States, counties, municipalities, and other Government agencies, produced either by themselves or by contractors expressly for their consumption, often with publicly owned equipment; they do not include purchases from commercial producers. Figures for "commercial operations" represent tonnages reported by all other producers.]

Year	Commercial operations				Noncommercial operations				Total	
	Short tons	Average value per ton	Percent of change in quantity from preceding year	Percent of total quantity	Short tons	Average value per ton	Percent of change in quantity from preceding year	Percent of total quantity	Short tons	Percent of change in quantity from preceding year
1945	59,347,220	$1.01	+4	93	4,760,970	$1.12	−40	7	64,108,190	−1
1946	83,879,680	1.07	+41	93	6,479,220	1.23	+36	7	90,358,900	+41
1947	95,178,440	1.19	+13	89	11,899,150	1.09	+84	11	107,077,590	+19
1948	108,029,360	1.23	+14	89	13,512,810	1.25	+14	11	121,542,170	+14
1949	111,094,390	1.27	+3	89	13,272,820	1.27	−2	11	124,367,210	+2

GRANULES

The output of granules for roofing purposes has been canvassed since 1942. The following table shows total production and value for the past 5 years. Separate figures for slate granules are given in the Slate chapter of this volume.

Roofing granules [1] sold or used in the United States, 1945–49, by kinds

Year	Natural		Artificially colored		Brick		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	355,840	$2,628,052	628,220	$9,124,891	61,220	$947,637	1,045,280	$12,700,580
1946	447,910	3,470,411	877,990	12,939,512	54,660	866,174	1,380,560	17,276,097
1947	504,980	4,166,810	1,133,870	17,559,227	56,570	998,434	1,695,420	22,724,471
1948	448,150	3,828,307	1,002,430	16,563,351	35,110	586,173	1,485,690	20,977,831
1949	352,846	3,088,402	977,934	16,489,253	23,425	400,919	1,354,205	19,978,574

[1] Manufactured from stone, slate, slag, and brick.

SIZE OF PLANTS

In 1948 the average crushed-stone plant produced approximately 131,000 short tons; in 1949 this average decreased to about 122,000 tons. During the year 579 plants reported a production of less than 25,000 tons, but they produced less than 3 percent of the total output while 26 plants that produced 900,000 tons or over contributed 22 percent of the total. The accompanying table shows additional details of the size pattern of the industry.

Number and production of commercial crushed-stone [1] plants in 1948-49, by size of output

Size of output	1948				1949			
	Number of plants	Total production of plants (short tons)	Percent of total	Cumulative total (short tons)	Number of plants	Total production of plants (short tons)	Percent of total	Cumulative total (short tons)
Less than 1,000 tons	45	19,910	0.01	19,910	60	21,250	0.01	21,250
1,000 to 25,000	493	5,312,260	2.56	5,332,170	519	5,542,200	2.72	5,563,450
25,000 to 50,000	272	9,836,410	4.75	15,168,580	259	9,291,880	4.57	14,855,330
50,000 to 75,000	199	12,245,870	5.91	27,414,450	224	13,742,110	6.75	28,597,440
75,000 to 100,000	103	8,785,280	4.24	36,199,730	107	9,095,350	4.47	37,692,790
100,000 to 200,000	211	29,510,390	14.24	65,710,120	231	32,079,020	15.77	69,771,810
200,000 to 300,000	106	25,757,880	12.43	91,468,000	112	27,188,560	13.36	96,960,370
300,000 to 400,000	54	18,704,550	9.03	110,172,550	49	16,611,580	8.17	113,571,950
400,000 to 500,000	29	13,103,030	6.32	123,275,580	29	13,151,480	6.46	126,723,430
500,000 to 600,000	15	8,303,370	4.01	131,578,950	17	9,413,340	4.63	136,136,770
600,000 to 700,000	12	7,574,620	3.66	139,153,570	12	7,746,050	3.81	143,882,820
700,000 to 800,000	7	5,182,000	2.50	144,335,570	10	7,545,410	3.71	151,428,230
800,000 to 900,000	10	8,474,400	4.09	152,809,970	7	6,540,890	3.21	157,969,120
900,000 tons and over	29	54,403,250	26.25	207,213,220	26	45,503,740	22.36	203,472,860
Total	1,585	207,213,220	100.00	207,213,220	1,662	203,472,860	100.00	203,472,860

[1] Exclusive of marble, which is primarily a dimension-stone industry.

METHODS OF TRANSPORTATION

As shown in the accompanying table, truck transportation is the principal method used in the crushed-stone industry, followed by rail shipments. As in past years, waterways provide relatively minor but locally important transportation facilities. In previous years the table included only transportation statistics on the commercial stone used for concrete and road metal, but since 1946 the table has included all commercial crushed stone.

Crushed stone sold or used in the United States in 1949, by methods of transportation

Method of transportation	Commercial operations		Commercial and noncommercial [1] operations	
	Short tons	Percent of total	Short tons	Percent of total
Truck	101,656,200	50	120,453,760	54
Rail	71,640,310	35	71,640,310	32
Waterway	21,419,240	11	21,419,240	10
Unspecified	8,894,830	4	8,894,830	4
Total	203,610,580	100	222,408,140	100

[1] Entire output of noncommercial operations assumed to be moved by truck.

GRANITE

Sales of crushed and broken granite in 1949 rose sharply, as gains of 26 percent in quantity and 29 percent in value were registered, while the average unit value increased 3 cents to $1.29. The most decisive gain was in granite sold for riprap, which advanced 173 percent in quantity and 146 percent in value. Crushed granite used for concrete and road metal increased 11 percent quantitywise and 19 percent in value, whereas stone for railroad ballast increased 66 percent in sales value and 50 percent in quantity. Granite for "other uses," such as grit, road base, stone sand, etc., also showed a substantial increase in output. Average unit values increased 9 cents to $1.40 for concrete and road metal and 11 cents for railroad ballast, while decreases of 12 cents and 38 cents were recorded for riprap and "other uses," respectively. North Carolina was the principal producer in 1949, followed by Georgia, South Carolina, California, and Virginia, in that order.

BASALT AND RELATED ROCKS (TRAPROCK)

Commercial traprock normally includes basalt, gabbro, diorite, and other dark igneous rocks and is widely used in industry for concrete and road metal and railroad ballast. Other uses include stone for riprap and such "other uses" as fill material, roofing granules, etc. In 1949 Oregon was the leading producer, followed by New Jersey, Washington, Pennsylvania, Connecticut, Massachusetts, and California, in that order. Sales of crushed and broken traprock were 4 percent greater in quantity and 2 percent greater in value than in 1948. The average unit values increased for riprap but decreased for all other end uses, while the grand average unit value for all uses decreased 3 cents to $1.42.

MARBLE

Marble producers, in the course of their manufacturing processes, accumulate large quantities of waste material consisting of either defective blocks or cuttings and spalls from marble-dressing operations. This byproduct material usually is marketed for the many uses listed in the footnote of the accompanying table. The average value varies from State to State, for the reason that in certain States a large portion of this material is marketed for such high-priced products as terrazzo or marble flour, whereas in other States a considerable amount is sold for roadstone, concrete aggregate, or other relatively low-priced uses. The average unit value for crushed and broken marble increased $1.47 to $8.28.

Marble (crushed and broken stone) sold by producers in the United States in 1949, by States [1]

State	Active plants	Short tons	Value	State	Active plants	Short tons	Value
Alabama	2	(2)	(2)	Texas	1	10,000	$200,000
California	1	3,930	$78,580	Utah	1	5,460	68,900
Georgia	1	(2)	(2)	Virginia	1	(2)	(2)
Maryland	1	8,600	138,155	Washington	6	2,680	14,060
Missouri	1	830	4,950	Undistributed		68,270	288,076
New Jersey	1	2,570	73,295				
New York	1	17,120	171,230	Total	21	137,720	1,140,220
Tennessee	4	18,260	102,974	Average unit value			$8.28

[1] Includes stone used for agriculture, asphalt filler, cast stone, composition flooring, crushed stone, magnesia, mineral food, plaster, poultry grit, shingles, spalls, stucco, terrazzo, tile, whiting (excluding marble whiting made by companies that purchase their marble), and unspecified uses.
[2] Included with "Undistributed."

Granite (crushed and broken stone) sold or used by producers in the United States in 1949, by States and uses

State	Riprap		Crushed stone				Other uses [1]		Total	
			Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Arizona	[2]	[2]	[2]	[2]			[2]	[2]	[2]	[2]
California	313,340	$133,779	821,480	$849,130	149,370	$107,688	466,610	$277,224	1,750,800	$1,367,821
Colorado	676,600	928,916	[2]	[2]	[2]	[2]			779,200	1,071,953
Connecticut	[2]	[2]							[2]	[2]
Delaware			35,240	88,100			2,000	4,000	37,240	92,100
Georgia	116,250	143,007	2,993,820	4,018,565	182,860	205,056	273,270	162,160	3,566,200	4,528,788
Idaho			[2]	[2]					[2]	[2]
Maine	2,360	2,522	5,730	14,705					8,090	17,227
Maryland	[2]	[2]	[2]	[2]					84,610	183,445
Massachusetts	[2]	[2]	237,590	342,765			[2]	[2]	267,180	379,444
Minnesota	2,450	4,002	78,190	108,329	[2]	[2]	[2]	[2]	316,190	374,581
Missouri	2,770	2,765							2,770	2,765
Montana	202,840	164,007	50,260	33,394					253,100	197,401
New Hampshire	[2]	[2]	[2]	[2]	[2]	[2]			2,940	4,375
New Jersey	[2]	[2]	[2]	[2]					[2]	[2]
New York			[2]	[2]					[2]	[2]
North Carolina	3,030	7,590	3,658,840	5,526,256	472,030	625,663	188,690	380,598	4,322,590	6,540,107
Oregon							2,450	31,140	2,450	31,140
Pennsylvania	2,770	3,365	61,910	101,311					64,680	104,676
Puerto Rico			16,600	16,600					16,600	16,600
Rhode Island	1,280	8,850					2,120	3,466	3,400	12,316
South Carolina	610	973	1,619,660	2,353,350	334,760	391,471	138,250	31,110	2,093,280	2,776,904
South Dakota	[2]	[2]	[2]	[2]					[2]	[2]
Vermont	[2]	[2]	[2]	[2]					[2]	[2]
Virginia			760,460	1,121,519	377,320	443,681	22,040	19,363	1,159,820	1,584,563
Washington	[2]	[2]	[2]	[2]			9,950	57,750	183,680	237,665
Wisconsin	[2]	[2]	[2]	[2]			[2]	[2]	126,210	94,512
Wyoming	21,680	29,190			1,059,540	1,250,256			1,081,220	1,279,446
Undistributed	176,770	233,239	506,610	588,113	314,590	345,507	93,200	90,887	335,940	353,533
Total	1,522,750	1,662,205	10,846,390	15,162,137	2,890,470	3,369,322	1,198,580	1,057,698	16,458,190	21,251,362
Average unit value		$1.09		$1.40		$1.17		$0.88		$1.29

[1] Includes stone used for poultry grit, road base, stone sand, and unspecified uses.
[2] Included with "Undistributed."

Basalt and related rocks (traprock) (crushed and broken stone) sold or used by producers in the United States in 1949, by States and uses

State	Riprap		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Other uses [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alaska	(2)	(2)	(2)	(2)			(2)	(2)	(2)	(2)
California	218,250	$342,357	1,163,420	$1,252,547	11,480	$12,831			1,393,150	$1,607,735
Connecticut	9,890	11,045	1,550,030	1,998,680	57,550	63,295			1,617,470	2,073,020
Hawaii			(2)	(2)	(2)	(2)			653,890	718,705
Idaho	(2)	(2)	1,009,840	1,455,137	(2)	(2)			1,255,560	1,690,074
Maine			17,590	41,350					17,590	41,350
Maryland	(2)	(2)	457,850	812,496	(2)	(2)			541,700	934,099
Massachusetts	(2)	(2)	1,185,420	1,562,757	156,990	164,465	(2)	(2)	1,518,900	1,942,109
Michigan	(2)	(2)	(2)	(2)					25,180	30,878
Minnesota	127,390	120,378	11,590	17,915	167,930	193,118			306,910	331,411
Montana	(2)	(2)							(2)	(2)
Nevada	(2)	(2)							(2)	(2)
New Jersey	106,350	178,288	3,280,460	5,867,459	89,940	119,156	21,740	$33,845	3,498,490	6,198,748
New York	(2)	(2)	1,008,860	1,729,999	(2)	(2)			1,076,930	1,821,460
North Carolina							(2)	(2)	(2)	(2)
Oregon	227,340	167,812	2,893,670	4,807,972	352,020	296,261	111,500	117,750	3,584,530	5,389,795
Pennsylvania	(2)	(2)	1,209,290	1,809,838	(2)	(2)			1,719,730	2,588,828
Puerto Rico			(2)	(2)	(2)	(2)			6,170	6,870
Rhode Island			50,000	100,000					50,000	100,000
Texas	(2)	(2)	(2)	(2)	(2)	(2)			(2)	(2)
Virginia			409,330	589,329					409,330	589,329
Washington	317,350	294,622	2,490,060	2,448,680	449,140	398,309	19,570	20,966	3,276,120	3,162,577
Wisconsin			49,000	59,832			(2)	(2)	(2)	(2)
Undistributed	381,990	431,538	807,430	952,735	765,470	996,817	165,160	918,979	399,240	1,161,570
Total	1,388,560	1,546,040	17,593,840	25,506,726	2,050,520	2,244,252	317,970	1,091,540	21,350,890	30,388,558
Average unit value		$1.11		$1.45		$1.09		$3.43		$1.42

[1] Includes stone sold for fill material, roofing granules, and unspecified uses.
[2] Included with "Undistributed."

LIMESTONE

Due to its chemical and physical properties, wide distribution, and comparatively moderate production costs, limestone is used more extensively than any other type of crushed and broken stone. Sales of limestone were reported to the Bureau of Mines from 44 States and 2 Territories in 1949. In 1949, limestone (excluding that used in the manufacture of cement and lime) constituted 73 percent of the total crushed and broken stone produced in the United States. Sales of stone for riprap, concrete and road metal, and agriculture increased over 1948, whereas the output of fluxing stone, railroad ballast, and stone for miscellaneous uses decreased in 1949. Details by States and uses are shown in an accompanying table.

Limestone (crushed and broken stone) sold or used by producers in the United States for miscellaneous uses, 1948–49

Use	1948		1949	
	Short tons	Value	Short tons	Value
Alkali works	7,349,540	$5,942,572	6,022,240	$5,641,705
Calcium carbide works	1,052,080	1,027,952	652,950	654,470
Coal-mine dusting	414,910	1,640,476	284,840	1,130,061
Filler (not whiting substitute):				
Asphalt	553,360	1,593,820	671,560	1,893,964
Fertilizer	612,040	1,155,690	666,260	1,361,999
Other	262,680	841,406	257,540	974,509
Filter beds	19,940	38,985	56,020	100,741
Glass factories	666,360	1,410,120	621,840	1,373,314
Limestone sand	1,033,820	954,544	1,241,340	1,196,921
Limestone whiting [1]	537,230	3,590,757	501,400	3,511,159
Magnesia works (dolomite) [2]	229,200	315,680	241,070	428,723
Mineral food	422,850	1,843,910	413,850	1,837,105
Mineral (rock) wool	40,540	47,053	42,600	50,737
Paper mills	475,880	908,098	417,850	766,856
Poultry grit	72,040	653,087	101,980	904,053
Refractory (dolomite)	1,323,090	1,497,285	1,365,700	1,485,004
Road base	272,640	229,054	934,720	710,369
Stucco, terrazzo, and artificial stone	36,520	381,282	47,670	505,268
Sugar factories	471,030	1,098,933	555,030	1,361,169
Other uses [3]	1,164,220	1,642,181	589,290	926,608
Use unspecified	517,740	663,115	575,160	813,559
Total	17,527,710	27,476,000	16,260,910	27,628,294

[1] Includes stone for filler for calcimine, caulking compounds, ceramics, chewing gum, explosives, floor coverings, foundry compounds, glue, grease, insecticides, leather goods, paint, paper, phonograph records, picture-frame moldings, plastics, pottery, putty, roofing, rubber, tooth paste, wire coating, and unspecified uses. Excludes limestone whiting made by companies from purchased stone.
[2] Includes stone for refractory magnesia.
[3] Includes stone for acid neutralization, athletic-field marking, carbon dioxide, chemicals (unspecified), concrete blocks and pipes, dyes, fill material, light bulbs, motion-picture snow, oil-well drilling, patching plaster, rayons, roofing granules, spalls, and water treatment.

Dolomite (calcium-magnesium carbonate) has many uses, some of them distinct from those of high-calcium limestone. Dead-burned dolomite is used as a refractory lining for metallurgical furnaces, and statistical data on this product (which is closely allied to lime) are given in the Lime chapter of this volume. Raw dolomite is also used as a refractory, particularly for patching furnace floors.

Sales of dolomite and its primary product of calcination—dolomitic lime—for certain uses are covered in the accompanying table.

Dolomite and dolomitic lime sold or used by producers in the United States for specified purposes, 1948–49

	1948		1949	
	Short tons	Value	Short tons	Value
Dolomite for—				
Basic magnesium carbonate [1]	229,200	$315,680	241,070	$428,723
Refractory uses	1,323,090	1,497,285	1,365,700	1,485,004
Dolomitic lime for—				
Refractory (dead-burned dolomite)	1,544,755	17,847,182	1,318,708	15,930,226
Paper mills	56,000	554,000	50,000	552,000
Total (calculated as raw stone)	4,754,000		4,344,000	

[1] Includes dolomite for refractory magnesia.

The following table shows the tonnages and values of fluxing stone sold for use in various metallurgical operations.

Sales of fluxing limestone, 1945–49, by uses

Year	Blast furnaces		Open-hearth plants		Other smelters [1]		Other metallurgical [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	21,901,820	$17,111,472	5,038,140	$4,286,889	502,230	$491,178	197,330	$186,854	27,639,520	$22,076,393
1946	19,674,130	15,803,857	4,869,300	4,342,467	449,050	490,566	165,280	154,943	25,157,760	20,791,833
1947	25,817,270	22,000,942	6,059,440	5,862,292	512,880	593,811	180,680	230,905	32,570,270	28,687,950
1948	26,339,790	24,721,052	7,873,410	8,695,137	503,490	609,354	185,250	224,465	34,901,940	34,250,008
1949	23,354,950	23,734,574	5,922,020	6,929,134	728,960	835,962	332,370	374,649	30,338,300	31,874,319

[1] Includes flux for copper, gold, lead, zinc, and unspecified smelters
[2] Includes flux for foundries and for cupola and electric furnaces.

As the statistics of the lime and cement industries are presented in separate chapters of the Minerals Yearbook, they are not covered in the Stone chapter. However, a commodity review of limestone would be incomplete without suitable recognition of the large tonnage of limestone consumed by these industries. Consequently, the following table shows the total tonnage of limestone consumed for all purposes.

Limestone sold or used for all purposes in the United States, 1947–49, in short tons

Use	1947	1948	1949
Limestone (as given in this report) (approximate)	150,409,000	166,742,000	163,746,000
Portland and natural cement and cement rock [1]	49,530,000	54,513,000	55,219,000
Lime [2]	13,558,000	14,528,000	12,637,000
Total	213,497,000	235,783,000	231,602,000

[1] Reported in terms of cement in Cement chapter of this volume.
[2] Reported in terms of lime in Lime chapter of this volume.

Limestone (crushed and broken stone) sold or used by producers in the United States in 1949, by States and uses

State	Riprap		Fluxing stone		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Agriculture		Miscellaneous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			1,766,820	$2,142,465	89,170	$109,975	80	$71	239,330	$277,349	278,140	$893,971	2,373,540	$3,423,831
Arizona			22,560	36,386	20,880	36,374					140	1,294	43,580	74,054
Arkansas			328,020	305,062	900,820	1,774,284	4,110	3,902	14,490	20,279	13,760	62,758	1,261,200	2,166,285
California	(1)	(1)	154,050	392,519	110,590	115,138			(1)	(1)	519,610	1,849,876	785,560	2,363,566
Colorado			404,310	781,289	129,250	312,321			40	29	61,400	110,357	595,000	1,203,996
Connecticut	(1)	(1)	(1)	(1)	420	1,184			36,290	138,307	(1)	(1)	67,720	246,834
Florida	(1)	(1)			3,067,440	3,511,622	407,300	359,308	(1)	(1)	634,930	499,301	4,215,090	4,748,253
Georgia					145,580	201,498			(1)	(1)	(1)	(1)	491,110	1,067,532
Hawaii											(1)	(1)	(1)	(1)
Idaho											(1)	(1)	(1)	(1)
Illinois	154,620	$186,440	922,180	1,188,016	9,418,920	10,763,323	727,830	700,350	4,692,530	6,149,866	1,098,810	1,615,360	17,014,890	20,603,355
Indiana	23,090	30,670	68,400	79,187	3,498,330	4,001,069	490,510	523,047	1,699,680	2,091,401	176,900	555,489	5,956,910	7,280,863
Iowa	130,360	155,299	18,130	26,361	4,711,010	5,440,695	30,270	36,469	1,880,410	2,633,301	60,370	369,732	6,830,550	8,661,857
Kansas	450,440	590,055			3,235,350	5,010,555	18,120	21,324	543,340	958,724	156,840	299,766	4,404,090	6,880,424
Kentucky	60,700	63,233			5,918,010	7,287,426	386,900	336,318	731,010	895,086	2,750	3,609	7,099,370	8,585,672
Louisiana											(1)	(1)	(1)	(1)
Maine	(1)	(1)			19,960	63,131			(1)	(1)	(1)	(1)	113,880	527,489
Maryland					1,081,350	1,492,994	21,000	27,300	16,280	80,132	330	820	1,118,960	1,601,246
Massachusetts	5,320	7,443	(1)	(1)	(1)	(1)			136,080	500,587	79,450	352,319	237,410	894,698
Michigan	(1)	(1)	9,150,950	6,365,985	2,706,840	2,374,866	(1)	(1)	700,640	880,090	3,769,900	3,476,038	16,490,890	13,282,239
Minnesota	16,790	25,358	1,250	2,100	991,210	1,083,102	620	1,050	164,800	231,585	32,950	102,132	1,207,620	1,445,327
Mississippi									(1)	(1)			(1)	(1)
Missouri	690,020	842,849	21,070	34,089	4,796,650	6,326,621	27,530	28,606	2,323,790	3,534,492	492,670	1,220,226	8,351,730	11,986,883
Montana	5,870	1,208	(1)	(1)	38,880	43,610	(1)	(1)			(1)	(1)	162,100	214,981
Nebraska	329,900	397,074			(1)	(1)					(1)	(1)	504,870	840,758
Nevada			(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)
New Jersey			11,950	24,069	(1)	(1)			134,750	483,749	(1)	(1)	278,250	1,245,879
New York	159,480	294,850	100,350	117,881	8,298,290	10,918,363	862,390	962,688	376,430	1,068,365	1,931,390	2,062,527	11,728,330	15,424,674

North Carolina					1,532,520	2,085,928	8,040	8,842	6,360	8,285			1,546,920	2,103,055
Ohio	68,340	78,891	5,845,950	5,763,627	8,385,890	9,797,166	1,029,630	1,116,061	2,422,970	3,651,067	1,339,350	2,800,846	19,092,130	23,207,658
Oklahoma	48,130	41,164	(1)	(1)	1,439,290	1,672,848	(1)	(1)	256,070	372,166	276,650	283,722	2,183,990	2,490,627
Oregon	(1)	(1)	(1)	(1)					118,900	186,578	(1)	(1)	378,360	539,561
Pennsylvania	110,470	192,333	8,033,490	10,435,309	6,797,930	10,167,862	235,610	301,901	981,840	2,670,767	1,547,800	3,093,960	17,707,140	26,862,132
Puerto Rico	(1)	(1)			478,480	782,214	4,370	5,250			(1)	(1)	488,770	794,217
Rhode Island									17,800	71,200			17,800	71,200
South Carolina					219,730	308,137	48,790	80,817	67,000	132,350			335,520	521,304
South Dakota	52,350	53,550			312,300	558,650					12,930	18,900	377,580	631,100
Tennessee	(1)	(1)	(1)	(1)	5,606,190	6,845,636	657,840	633,864	824,230	1,029,301	277,380	564,328	7,529,950	9,246,303
Texas	56,230	56,744	258,460	247,323	2,335,120	2,716,105	239,420	176,644	71,330	67,228	577,240	660,144	3,537,800	3,924,188
Utah			(1)	(1)	44,780	17,090					(1)	(1)	155,830	228,880
Vermont	(1)	(1)	(1)	(1)	74,820	93,696	(1)	(1)	90,580	365,631	98,400	735,281	329,480	1,292,057
Virginia	89,660	124,232	163,990	214,008	2,996,080	4,131,073	476,870	449,507	1,010,870	1,430,050	998,180	1,829,389	5,735,590	8,178,259
Washington			(1)	(1)					(1)	(1)	107,430	241,725	137,780	317,705
West Virginia	35,390	56,632	2,487,090	2,974,262	1,115,390	1,737,161	432,740	402,536	68,580	138,386	158,500	411,356	4,297,690	5,720,333
Wisconsin	78,140	59,748	106,700	117,078	4,466,990	4,455,859	141,560	152,895	1,435,760	1,970,240	247,200	357,776	6,476,350	7,113,596
Wyoming	(1)	(1)	(1)	(1)	11,000	11,361	441,150	400,103			154,170	390,771	716,580	914,214
Undistributed	240,990	246,039	472,580	627,303	159,370	292,873	330,600	314,242	420,730	1,214,550	1,155,340	2,764,521	688,550	915,386
Total	2,806,230	3,503,812	30,338,300	31,874,319	85,154,830	106,541,810	7,023,280	7,043,095	21,482,910	33,251,141	16,260,910	27,628,294	163,066,460	209,842,471
Average unit value		$1.25		$1.05		$1.25		$1.00		$1.55		$1.70		$1.29

[1] Included with "Undistributed."

SANDSTONE

Sales of crushed and broken sandstone in 1949 decreased 5 percent in quantity but increased 10 percent in value compared with 1948. A substantial increase in the tonnage for riprap is noteworthy, but decreases in output were recorded for refractory stone, concrete and road metal, railroad ballast, and "other uses." Average unit values increased for all end uses while the grand average unit increased 31 cents to $2.27.

MISCELLANEOUS STONE

Crushed and broken stone, other than the five principal varieties already discussed, includes light-colored volcanic rocks, schists, boulders from river beds, serpentine, chats, and flint. The following table shows sales of stone of these types in 1949. The output during 1949 decreased 13 percent quantitywise and 19 percent in value compared with 1948. California was the principal producer in 1949, followed by Oklahoma, Kansas, and Missouri, in that order. The average unit value decreased 6 cents to $0.81.

MARKETS

The principal use of crushed stone is as aggregate in concrete for both highway and building construction. It is natural, therefore, that crushed-stone sales should follow the trends of Portland-cement shipments, the area of new concrete pavements, and the value of new construction. These relationships are shown in figure 3.

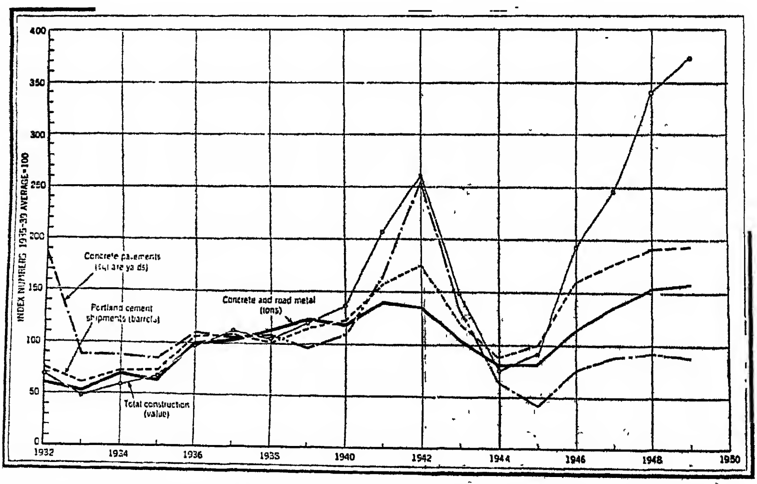

FIGURE 3.—Crushed-stone aggregates (concrete and road metal) sold or used in the United States compared with shipments of Portland cement, total construction (value), and concrete pavements (contract awards, square yards), 1932–49. Data on construction and concrete pavements from Survey of Current Business.

Sandstone (crushed and broken stone) sold or used by producers in the United States in 1949, by States and uses

State	Refractory stone (ganister)		Riprap		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Other uses [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(2)	(2)			(2)	(2)					(2)	(2)
Arizona			(2)	(2)							(2)	(2)
Arkansas	(2)	(2)			(2)	(2)					17,160	$64,351
California	4,730	$42,579	(2)	(2)	1,103,810	$1,237,576	(2)	(2)	(2)	(2)	1,611,870	1,614,939
Colorado	17,910	38,180	168,450	$112,838	13,500	12,500	(2)	(2)	(2)	(2)	349,700	301,903
Illinois	630	8,968									630	8,968
Kansas			4,140	3,515	139,190	209,820	32,280	$39,710			175,610	253,045
Michigan	(2)	(2)									(2)	(2)
Minnesota			(2)	(2)							(2)	(2)
Missouri			(2)	(2)							(2)	(2)
Montana			4,500	1,950			183,120	146,915			187,620	148,865
Nebraska			(2)	(2)					(2)	(2)	(2)	(2)
New Mexico							135,040	101,239			135,040	101,239
New York					71,250	107,500					71,250	107,500
North Carolina					(2)	(2)					(2)	(2)
Ohio	81,920	1,120,337	56,750	111,663					11,070	$6,152	149,740	1,238,152
Oklahoma			(2)	(2)	(2)	(2)					(2)	(2)
Pennsylvania	580,780	2,354,103	(2)	(2)	673,310	1,148,244	101,080	153,077	(2)	(2)	1,359,640	3,666,117
South Dakota	(2)	(2)	(2)	(2)	520,020	947,688					622,390	1,121,497
Tennessee									(2)	(2)	(2)	(2)
Utah	5,200	15,308			48,130	17,368					53,330	32,671
Virginia	65,370	183,582			34,600	82,362	9,500	9,500	3,050	5,677	112,520	281,121
Washington			290	2,833							290	2,833
West Virginia	(2)	(2)	(2)	(2)	(2)	(2)			(2)	(2)	549,950	1,214,353
Wisconsin	(2)	(2)	1,200	1,100					(2)	(2)	512,310	3,337,499
Wyoming							(2)	(2)			(2)	(2)
Undistributed	249,520	1,005,923	888,940	1,937,369	189,560	307,864	3,920	2,588	1,326,310	3,769,845	820,020	1,750,815
Total	1,006,060	4,763,980	1,124,270	2,171,268	2,793,370	4,070,917	464,940	453,029	1,340,430	3,781,674	6,729,070	15,245,868
Average unit value		$4.74		$1.93		$1.46		$0.97		$2.82		$2.27

[1] Includes sandstone for fill material, filter stone, road base, roofing granules, spalls, stone sand, and unspecified uses.
[2] Included with "Undistributed."

Miscellaneous varieties of stone (crushed and broken stone) sold or used by producers in the United States in 1949, by States and uses

State	Riprap		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Other uses [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alaska	(2)	(2)	(2)	(2)					(2)	(2)
Arizona	(2)	(2)	(2)	(2)					207,450	$79,316
Arkansas	(2)	(2)	(2)	(2)	(2)	(2)			(2)	(2)
California	167,060	$268,076	4,463,690	$3,874,254	504,530	$398,754	677,650	$660,173	5,812,930	5,201,257
Colorado			(2)	(2)	(2)	(2)			83,970	77,431
Georgia			13,000	15,250					13,000	15,250
Idaho	30,160	29,565	106,220	94,009					136,380	123,574
Illinois			(2)	(2)					(2)	(2)
Kansas [3]			97,060	44,049	1,272,140	406,554	6,080	5,284	1,375,280	455,887
Maine	1,700	1,705	95,660	95,658					97,360	97,363
Maryland	1,540	5,752	20,000	30,000			670	335	22,210	36,087
Massachusetts	(2)	(2)	(2)	(2)					191,500	258,750
Michigan			(2)	(2)			(2)	(2)	24,030	28,660
Missouri [3]	(2)	(2)	290,280	158,352	577,970	183,747	(2)	(2)	1,077,410	434,266
Montana					(2)	(2)			(2)	(2)
Nevada			315,260	288,637					315,260	288,637
New Jersey			(2)	(2)					(2)	(2)
New York	(2)	(2)	53,410	52,077	(2)	(2)			96,860	91,634
North Carolina			(2)	(2)			(2)	(2)	287,250	308,166
North Dakota	(2)	(2)							(2)	(2)
Ohio			(2)	(2)					(2)	(2)
Oklahoma [3]			548,750	297,452	1,584,110	649,790			2,132,860	947,242
Oregon	(2)	(2)	253,560	273,640	(2)	(2)			420,060	492,662
Pennsylvania	(2)	(2)	152,350	247,127			(2)	(2)	226,570	868,549
Rhode Island			(2)	(2)					(2)	(2)
South Carolina			(2)	(2)					(2)	(2)
Texas	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	450,470	202,224
Utah	(2)	(2)	(2)	(2)	(2)	(2)			66,060	78,567
Virginia			(2)	(2)			(2)	(2)	71,760	88,182
Washington	(2)	(2)	(2)	(2)					82,730	55,231
West Virginia	(2)	(2)							(2)	(2)
Wisconsin			(2)	(2)					(2)	(2)
Undistributed	526,120	641,203	1,569,540	1,605,816	686,220	628,337	651,080	871,445	1,474,410	1,598,106
Total	726,580	946,301	7,978,780	7,076,321	4,624,970	2,267,182	1,335,480	1,537,237	14,665,810	11,827,041
Average unit value		$1.30		$0.89		$0.49		$1.15		$0.81

[1] Includes stone used for agriculture, asphalt filler, fill material, refractory, road base, roofing granules, spalls, and unspecified uses.
[2] Included with "Undistributed."
[3] Chats; figures collected by Denver, Colo., office of the Bureau of Mines. Kansas and Missouri figures also include stone.

The metallurgical industries in 1949 operated at a lower level than in 1948. Pig-iron production of 53 million short tons was 11 percent below the previous year's total; and steel production—78 million tons—was 12 percent below that of 1948. As a result of these decreases, metallurgical stone sales in 1949 were off 13 percent. The correlations of fluxing-stone output with pig-iron production and of refractory stone with steel-ingot production are shown in figure 4.

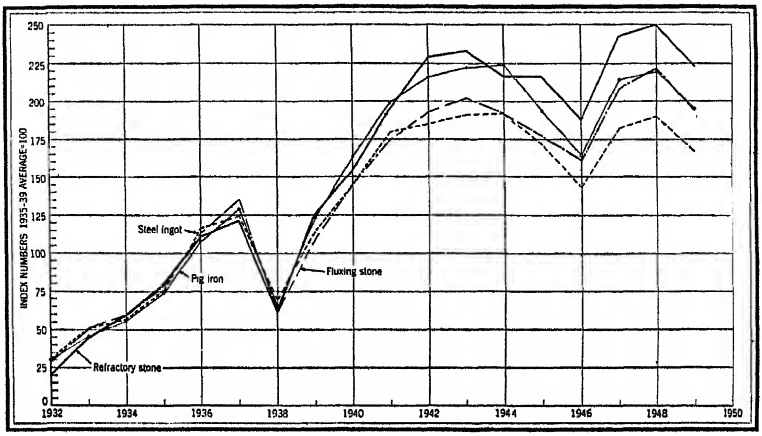

FIGURE 4.—Sales (tons) of fluxing stone and refractory stone (including that used in making lime) compared with production of steel ingot and pig iron, 1932–49. Statistics of steel-ingot production compiled by American Iron and Steel Institute.

TECHNOLOGY

The use of "skull breakers" continues to hold the attention of stone operators. Their performance in granite and limestones recently has been reviewed in the literature.[7]

Numerous articles describing thermic rock drilling (jet piercing) have appeared in the trade journals. According to one report, this type of drilling is accomplished by directing a jet of flame against the rock surface. A petroleum-base fuel, oxygen, and a special blowpipe are used. The intense heat of the flame causes the solid rock to disintegrate, and the pressure of the burning gases forces the spalled particles past a water spray in back of the blowpipe burner. This in turn enables the hardened-steel blades on the revolving "hole sizer" to drill through the embrittled rock. The steam, in combination with gas pressure, forces the rock chips out of the hole.[8]

[7] Rock Products, vol. 52, No. 6, June 1949, p. 90; vol. 52, No. 5, May 1949, p. 89.
[8] Rock Products, vol. 52, No. 3, March 1949, p. 117.
Mine & Quarry Engineering, vol. 15, No. 12, December 1949, p. 400.
Lenhart, W. B., Jet-Piercing Method of Drilling Quartzite: Rock Products, vol. 52, No. 11, November 1949, pp. 72–74.
Excavating Engineer, vol. 43, No. 1, January 1949, p. 44.
Lenhart, W. B., Jet Piercing—Modern Technique for Drilling Rock: Rock Products, vol. 52, No. 11, November 1949, pp. 60–63, 86.
Avery, W. M., Jet Piercing at Kingston: Pit and Quarry, vol. 42, No. 5, November 1949, pp. 108–111.

Rock blasting by "timed delays" and "multiple-jet" shaped charges have been reported as having possibilities. According to one report, if explosions are timed to follow one another at split-second intervals, improved breakage, less vibration, and less noise result.[9] The principle of jet-shaped charge is similar to that used in the "bazooka" weapon. Details of the method have been described in the literature.[10]

As in the past few years, the problem of alkali-aggregate reactivity continued to hold attention of the industry. Results of research and various reports on this important phase of aggregates, as applied to concrete, have been reported by technical societies and in the literature.[11]

A method for determining the quantity of soft particles in coarse aggregates, by using a brass rod at a certain hardness, has been established by the American Society for Testing Materials.[12]

A stone plasticizer (Canadian Patent 444,434) containing ethylcellulose to be used for decorating and protecting artificial and natural stone has been announced.[13] Two reports have been released by the Bureau of Mines, one on the properties of various mine rock [14] and another on a travertine deposit in Washington.[15]

FOREIGN TRADE [16]

The importation of stone into the United States in 1949 increased slightly in value compared with 1948. The greatest gain, from the standpoint of value, was made by marble, although "other" stone also made a sizable increase in total value. Values of importations of granite, quartzite, and travertine decreased below the 1948 level.

The export trade in 1949, covering marble and other building and monumental stone, decreased about a third from the 1948 value, but "other manufactures of stone" increased slightly in value.

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[9] Science News Letter, vol. 56, No. 19, Nov. 5, 1949, p. 296.

[10] Byers, L. S., The Multiple-Jet Shaped Blasting Charge—Why it Functions: Pit and Quarry, vol. 42 No. 5, November 1949, pp. 99–102.

[11] Crushed Stone Journal, vol. 24, No. 2, June 1949, pp. 8–9.
Scholer, C. H., A Wetting-and-Drying Test for Predicting Cement-Aggregate Reaction: Paper presented at annual meeting, Am. Soc. Test. Mat., June 27 to July 1, 1949, Atlantic City, N. J.
Slate, F. O., Chemical Reactions of Indiana Aggregate in Disintegration of Concrete: Paper presented at annual meeting, Am. Soc. Test. Mat., June 27 to July 1, 1949, Atlantic City, N. J.
Rock Products, vol. 52, No. 3, March 1949, p. 98.

[12] A. S. T. M. Designation C — - 49T: Report of Committee C-9 on Concrete and Concrete Aggregates, presented at annual meeting of the society, June 27–July 1, 1949, Atlantic City, N. J.

[13] Oil, Paint and Drug Reporter, vol. 156, No. 2, Nov. 14, 1949, p. 55.

[14] Windes, S. L., Physical Properties of Mine Rock, Part I: Bureau of Mines Rept. of Investigations 4459, 1949, 79 pp.

[15] Popoff, C. C., Investigation of the Whitechuck Travertine Deposit near Darrington, Snohomish County, Wash.: Bureau of Mines Rept. of Investigations 4565, 1949, 4 pp.

[16] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Stone and whiting imported for consumption in the United States, 1948-49, by classes

[U. S. Department of Commerce]

Class	1948 Quantity	1948 Value	1949 Quantity	1949 Value
Marble, breccia, and onyx:				
Sawed or dressed, over 2 inches thick ---------- cubic feet	684	$5,586	12,968	$8,935
In blocks, rough, etc ---------- do	109,345	436,305	130,331	590,202
Slabs or paving tiles ---------- superficial feet	147,053	85,197	208,709	129,884
All other manufactures	----------	132,429	----------	201,301
Total	----------	659,517	----------	930,322
Granite:				
Dressed ---------- cubic feet	23,537	218,213	19,021	67,226
Rough ---------- do	84,504	265,962	82,194	261,651
Paving blocks, wholly or partly manufactured ---------- number	1	71	----------	----------
Total	----------	484,246	----------	328,877
Quartzite ---------- short tons	[1] 225,341	[1] 488,789	144,545	341,913
Travertine stone ---------- cubic feet	51,259	85,643	41,074	82,654
Stone (other):				
Dressed	----------	3,957	----------	8,462
Rough (monumental or building stone) ---------- cubic feet	4,516	6,078	1,548	3,403
Rough (other) ---------- short tons	43,590	100,612	52,258	122,417
Marble chip or granito ---------- do	7,743	70,988	12,739	120,413
Crushed or ground, n. s. p. f.	----------	4,833	----------	7,734
Total	----------	186,468	----------	262,429
Whiting:				
Chalk or whiting, precipitated ---------- short tons	1,253	58,629	1,534	68,365
Whiting, dry, ground, or bolted ---------- do	7,268	109,311	7,818	124,065
Whiting, ground in oil (putty) ---------- do	(2)	37	(2)	56
Total	----------	167,977	----------	192,486
Grand total	----------	[1] 2,072,640	----------	2,138,681

[1] Revised figure.
[2] Less than 1 ton.

Stone exported from the United States, 1945-49

[U. S. Department of Commerce]

Year	Marble and other building and monumental stone: Cubic feet	Marble and other building and monumental stone: Value	Other manufactures of stone (value)
1945	119,004	$337,666	$174,874
1946	224,692	463,572	280,380
1947	320,016	583,826	[1] 549,591
1948	345,697	584,050	[1] 430,862
1949	211,334	523,171	436,705

[1] Revised figure.

Sulfur and Pyrites

By G. W. Josephson and M. G. Downey [1]

GENERAL SUMMARY

WORLD-WIDE demand for sulfur continued at a high level in 1949. Production of native sulfur in the United States and for the world as a whole was nearly as high as in 1948. Output of native sulfur in Italy was still handicapped by high production costs, and therefore relatively little progress was made during the year. World demand for American native sulfur again exceeded the capacity of the mines, and stocks continued to decline.

Preference of consumers for native sulfur has in some degree hindered expansion of pyrite output in certain foreign countries as well as in the United States. However, world pyrite production in 1949 recovered to approximately the prewar level.

Salient statistics of the sulfur industry in the United States, 1935–39 (average) and 1946–49

	1935–39 (average)	1946	1947	1948	1949
Sulfur:					
Production of crude sulfur..long tons..	2,175,057	3,859,642	4,441,214	4,869,210	4,745,014
Shipments of crude sulfur—					
For domestic consumption..do....	1,420,236	2,939,140	3,529,043	3,715,999	3,358,395
For export..do....	566,361	1,189,072	1,299,060	1,262,913	1,430,916
Total shipments..do....	1,986,597	4,128,212	4,828,103	4,978,912	4,789,311
Imports:					
Ore..do....	555				5
Other..do....	3,427	35	15	38	27
Exports of treated sulfur..do....	16,374	56,748	50,477	32,630	30,051
Mine stocks at end of year..do....	3,560,000	3,200,000	2,800,000	2,700,000	2,650,000
Price of crude sulfur per long ton f. o. b. mines..	$17.40	$16	$16–$18	$18	$18
Pyrites:					
Production..long tons..	544,144	813,372	940,652	928,531	888,388
Imports..do....	433,485	182,893	126,553	107,411	120,937
Price of imported pyrites c. i. f. Atlantic ports, cents per long-ton unit..	12–13	14	15	15	15
Sulfuric acid: Production of byproduct sulfuric acid (basis, 100 percent) at copper and zinc plants..short tons..	564,794	716,216	725,197	641,445	573,276

A noteworthy development during the year was the growing consideration being given both by producers and consumers to reserve problems. Consumption has become so great that serious efforts are being made to broaden the base of mineral reserves on which the industry rests. This may be accomplished through the numerous native-sulfur exploration programs in progress or by bringing in higher-cost sources of supply.

Sulfur prices were stable during 1949.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

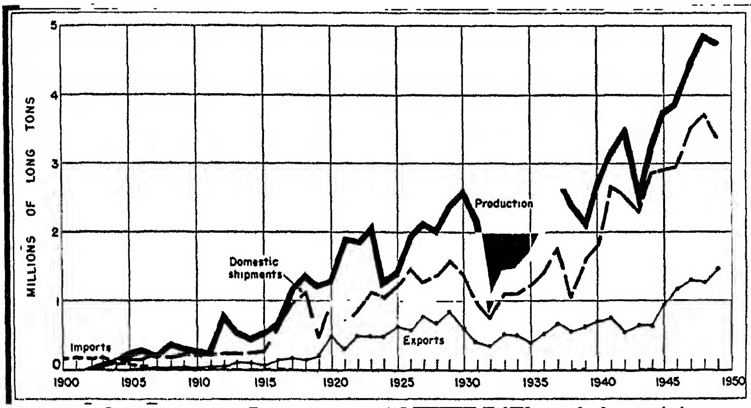

FIGURE 1.—Domestic production, shipments for domestic consumption, exports, and imports of crude sulfur, 1900–49.

SULFUR

DOMESTIC PRODUCTION

The domestic sulfur industry produced 4,745,014 long tons of native sulfur from Frasch-process mines during 1949, less than 3 percent under the record established in 1948. Demand from both domestic and foreign consumers was greater than this high production rate could satisfy, and shipments from the mines totaled 4,789,311 long tons. In addition to the Frasch sulfur, a total of 5,678 long tons of sulfur ore was produced by conventional mining methods in California, Colorado, Nevada, and Wyoming. In general, this material does not reach a high state of refinement and is consumed principally in treating alkaline soils.

Of the native sulfur produced in the United States in 1949, Texas contributed 76 and Louisiana about 24 percent.

California.—The only sulfur reported from California in 1949 was produced by Roy E. Kitching, who operated the Crater claims in Inyo County. The Siskon Mining Corp. reported that the Leviathan mine was idle.

Colorado.—The General Agricultural Products Co. produced sulfur ore at its mine in Delta County, Colo., during the first half of the year. The mine was leased to and operated by B. E. Warren during the latter part of the year.

Louisiana.—A new record was established in 1949 for sulfur output in Louisiana. A total of 1,134,185 long tons was produced by the Freeport Sulphur Co. from the Grande Ecaille mine.

Nevada.—W. S. Peterson operated the Streeter mine in Humboldt County, Nev. The organization of the Nevada Sulphur Co. was changed in 1949, but no output was reported from its property in Humboldt and Pershing Counties.

Texas.—Sulfur was produced in Texas by the following firms in 1949: Duval Texas Sulphur Co., at Orchard Dome, Fort Bend County; Freeport Sulphur Co., at Hoskins Mound, Brazoria County; Jefferson

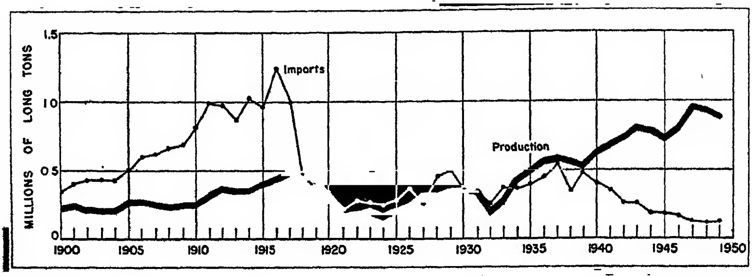

FIGURE 2.—Domestic production and imports of pyrites, 1900–49.

Sulfur produced and shipped in the United States, 1945–49 [1]

Year	Produced (long tons)			Shipped	
	Texas	Louisiana	Total	Long tons	Approximate value
1945	2,969,778	783,410	3,753,188	3,833,294	$61,300,000
1946	2,975,472	884,170	3,859,642	4,128,212	66,100,000
1947	3,561,214	880,000	4,441,214	4,828,103	85,200,000
1948	3,867,545	1,001,665	4,869,210	4,978,912	89,600,000
1949	3,610,829	1,134,185	4,745,014	4,789,311	86,200,000

[1] In addition to the refined sulfur shown, native sulfur ore (10–70 percent S) for agricultural use was produced in Colorado in 1945–49, in California and Nevada in 1946–49, in Texas in 1945–48, and in Wyoming in 1949. Total shipments of this material were as follows, in long tons: 1945—1,615 ($12,170); 1946—6,344 ($95,531); 1947—4,303 ($65,124); 1948—1,700 ($30,220); 1949—5,392 ($101,991).

Sulfur produced in Texas in 1949, by companies, in long tons

Company	First quarter	Second quarter	Third quarter	Fourth quarter	Total
Texas Gulf Sulphur Co.	716,393	701,866	685,630	693,539	2,797,428
Freeport Sulphur Co.	86,300	90,695	81,290	83,695	341,980
Jefferson Lake Sulphur Co., Inc.	56,197	70,422	69,182	54,765	250,566
Duval Texas Sulphur Co.	69,625	67,240	47,230	36,760	220,855
Total	928,515	930,223	883,332	868,759	3,610,829

Lake Sulphur Co., Inc., at Clemens Dome, Brazoria County, and at Long Point Dome, Fort Bend County; and Texas Gulf Sulphur Co., at Boling Dome, Wharton County, and at Moss Bluff Dome, Liberty County. The Pecos Orla Sulphur Co. reported no production from its Michigan claims in Culberson County during the year.

The Moss Bluff Dome was put into production by the Texas Gulf Sulphur Co. in 1948 and operated continuously throughout 1949, though it was reported that difficulties resulted in an output lower than anticipated.

Exploration wells were drilled by Texas Gulf Sulphur Co. at the Spindletop Dome in Texas.[2] Shipping facilities at Galveston were expanded.[3]

Output from Clemens Dome was greater in 1949 than in 1948. This dome has been in production for 13 years, and new reserves that have

[2] Texas Gulf Sulphur Co., Annual Report, 1949.
[3] Manufacturers Record, vol. 118, No. 10, October 1949, p. 52.

been found are expected to support a production rate of 75,000 tons during 1950. Extension of the life of this property is attributed to effective application of the mudding process. Exploration at Long Point Dome has proved sufficient reserves to indicate a 10- to 12-year productive life at this location.[4]

The Markham Dome in Matagorda County, Tex., was explored with three test wells by the Jefferson Lake Sulphur Co., but, as no sulfur mineralization was found, exploration was discontinued.[5]

Wyoming.—Sulfur ore was produced by Wyoming Mineral Products Co. near Cody in Park County; by Star Valley Mines, Inc., at Afton in Lincoln County; and by the Cody Sulfur Co. at Cody in Park County.

RECOVERY AS BYPRODUCT

At present the major sulfur supplies in the United States come from the native sulfur deposits mentioned in the previous section, with the pyrites mined as the primary product at a number of locations in the United States or imported from abroad second in importance. In addition to this direct production of sulfur minerals, substantial quantities of surfur are recovered as byproducts of other operations.

In the beneficiation of copper, zinc, and lead ores, large tonnages of byproduct flotation concentrates are recovered. Similarly, a relatively small quantity of coal brasses are obtained from washing midwestern coals in which the pyrite content is high and concentrated in thick seams. The statistics of these byproduct pyrites are included in the pyrites section of this chapter.

Large quantities of sulfur-bearing gases are released in the smelting of metal sulfide ores. As such gas is an expensive nuisance in the vicinity of the smelter and as in some locations it can be marketed profitably in the form of sulfuric acid, a substantial quantity of sulfur is recovered in this form. In 1949 the equivalent of about 167,000 long tons of sulfur (187,000 in 1948) was obtained as sulfuric acid from metal smelting plants. The following table shows the output of acid at smelters during the past 5 years. Full use of all the available smelter gas is not yet profitable. Total recovery has declined somewhat in recent years.

Sulfur fumes also are evolved in the course of many other industrial operations, but in most instances the quantity available at a single plant is too small to allow economic recovery. However, there is growing interest in the recovery of sulfur from gases. This interest was shown in numerous technical articles, in development and research programs being conducted by private firms, and in a number of actual commercial or semicommercial plants being built. The trend has been due partly to the attention being given to smog problems in cities and in part to the prospect of profitable recovery.

A major source of byproduct sulfur is the sour natural gas that occurs in various oil fields. A substantial quantity of elemental sulfur is now being recovered from sour gas, and the quantity is expected to increase considerably in future. During 1949 one new plant, that of the Stanolind Oil & Gas Co., was put into production in Wyo-

[4] Jefferson Lake Sulphur Co., Annual Report, 1949, pp. 8–9.
[5] Jefferson Lake Sulphur Co., Annual Report, 1949, p. 11.

Byproduct sulfuric acid (basis, 100 percent) produced at copper, zinc, and lead plants in the United States, 1945–49, in short tons

	1945	1946	1947	1948	1949
Copper plants [1]	231,697	171,687	126,494	111,967	96,344
Zinc plants	610,938	544,529	598,703	529,478	476,932
Total	842,635	716,216	725,197	641,445	573,276

[1] Includes sulfuric acid produced as byproduct at a lead smelter.

ming; and another, a 300-ton-per-day unit at Worland, being built by the Texas Gulf Sulphur Co. to use sour gas furnished by the Pure Oil Co., was nearing completion. The Hancock Chemical Co.[6] began treating oil-refinery gases at a new plant in the Los Angeles area and expansion was already under way. The sulfur is used at a nearby acid plant. The Freeport Sulphur Co. constructed a plant near Westville, N. J., to recover elemental sulfur from refinery gases of the Texas Co. This plant was slated to be in operation early in 1950. The Mathieson Chemical Corp. purchased the Southern Acid & Sulphur Co., which operates two elemental sulfur-recovery plants using Arkansas sour gas.[7]

In 1949, 56,781 long tons of elemental sulfur (calculated as 100 percent sulfur) were recovered in 11 States from coke-oven, refinery, natural, and other industrial gases by the Thylox, Sasco, and other processes. Shipments totaled 42,268 long tons; 94 percent was sold in the form of brimstone and the remainder as paste containing 40 to 52 percent sulfur. In addition, 44,369 tons of hydrogen sulfide (containing 37,935 long tons of sulfur) were recovered in 1949 in four States by the Phosphate, Girbotol, and other processes.

CONSUMPTION AND USES

As shown in the accompanying table, both apparent domestic consumption and apparent shipments to consumers (apparent sales)—a calculated figure that includes exports—were somewhat lower than in the record year 1948. Apparent consumption declined 8 percent and apparent domestic sales 3 percent.

Apparent consumption of sulfur in the United States, 1945–49, in long tons

	1945	1946	1947	1948	1949
Shipments to consumers (apparent)	3,849,591	4,094,191	4,839,548	5,015,230	4,870,723
Imports	33	35	15	38	32
Total	3,849,624	4,094,226	4,839,563	5,015,268	4,870,755
Exports:					
Crude	918,691	1,189,072	1,299,060	1,262,913	1,430,916
Refined	23,971	56,748	50,477	32,630	30,051
Total	942,662	1,245,820	1,349,537	1,295,543	1,460,967
Apparent consumption	2,906,962	2,848,406	3,490,026	3,719,725	3,409,788

[6] Chemical Industries, Sulfur from Refinery Gas: Vol. 65, No. 6, December 1949, p. 898.
[7] Chemical Engineering, vol. 56, No. 3, March 1949, pp. 76–78.

The pattern of sulfur consumption by industries, as estimated by Chemical Engineering, is shown in the following table. These estimates show a general reduction in consumption in nearly all uses and a total decline in 1949 of about 5 percent below 1948, somewhat smaller than indicated in the calculation of apparent consumption. The difference can be explained, at least in part, by variation in consignment shipments and consumers' stocks from year to year.

Sulfur consumed in the United States, 1945–49, by uses, in long tons

[Chemical Engineering]

Use	1945	1946	1947	1948	1949
Chemicals [1]	1,605,000	1,460,000	1,760,000	1,790,000	1,765,000
Fertilizers and insecticides	600,000	620,000	740,000	800,000	740,000
Pulp and paper	297,000	305,000	370,000	380,000	330,000
Explosives [1]	90,000	90,000	100,000	110,000	98,000
Dyes and coal-tar products	75,000	80,000	95,000	98,000	94,000
Rubber	58,000	65,000	65,000	63,000	53,000
Paint and varnish	94,000	105,000	190,000	240,000	210,000
Food products	7,000	7,000	8,000	8,000	8,000
Miscellaneous	135,000	175,000	212,000	211,000	202,000
Total	2,961,000	2,907,000	3,540,000	3,700,000	3,500,000

[1] To avoid disclosing estimated consumption of sulfur in direct war applications, such as military explosives, sulfur so used is included with "Chemicals."

Sulfur in elemental form is consumed in substantial tonnages in the manufacture of rubber, insecticides, and other products. A large tonnage is also converted into various other sulfur compounds for use in making such products as paper pulp. However, the largest fraction—about three-fourths of the total annual consumption—is converted into sulfuric acid.

As shown in the accompanying table, compiled by Chemical Engineering, sulfuric acid has extremely wide utility in industry.

Sulfuric acid (basis, 100 percent) consumed in the United States, 1945–49, by industries, in short tons

[Chemical Engineering]

Industry	1945	1946	1947 [1]	1948 [1]	1949
Fertilizer	2,850,000	3,020,000	3,410,000	3,480,000	3,470,000
Chemicals	[2] 2,220,000	1,760,000	2,010,000	2,100,000	2,060,000
Petroleum refining	1,020,000	1,000,000	1,180,000	1,220,000	1,210,000
Paints and pigments	520,000	550,000	665,000	680,000	670,000
Coal products	600,000	510,000	698,000	670,000	620,000
Rayon and cellulose film	495,000	556,000	610,000	640,000	650,000
Iron and steel	570,000	475,000	540,000	565,000	520,000
Other metallurgical	330,000	280,000	315,000	320,000	325,000
Industrial explosives	[2] 100,000	105,000	125,000	130,000	123,000
Textiles	70,000	75,000	73,000	70,000	75,000
Miscellaneous	400,000	320,000	369,000	370,000	377,000
Total	9,175,000	8,651,000	9,995,000	10,245,000	10,100,000

[1] Revised figures.

[2] To avoid disclosing estimated consumption of acid in direct war applications, such as military explosives, acid so used is combined with "Chemicals."

In 1949 sulfuric acid consumption declined about 1 percent, and the reduction is estimated to have been well distributed over the entire field of consumption.

As such a large fraction of the total sulfur consumption goes into sulfuric acid, some conception of the location of sulfur markets may be obtained from the accompanying table of sulfuric acid production compiled from reports of the Bureau of the Census.

Production of new sulfuric acid (100 percent H_2SO_4), by regions and by States, 1947–49

[Bureau of the Census]

Region and State	1947[1]		1948		1949	
	Number of producing establishments	Production (short tons)	Number of producing establishments	Production (short tons)	Number of producing establishments	Production (short tons)
New England[2]	5	183,151	5	188,243	5	158,675
Middle Atlantic:						
Pennsylvania	14	855,608	11	735,467	11	619,923
Other[3]	13	1,432,890	13	1,311,898	13	1,136,654
Total Middle Atlantic	27	2,288,498	24	2,047,365	24	1,756,577
North Central:						
Illinois	14	1,348,909 (Illinois and Indiana)	15	964,596	14	868,235
Indiana	4		4	429,025	4	415,766
Michigan	5	133,244	5	177,508	5	180,570
Ohio	14	624,377	16	665,478	15	617,673
Other[4]	3	312,271	5	377,836	5	437,462
Total North Central	40	2,418,801	45	2,614,443	43	2,519,706
South:						
Alabama	10	184,333	10	307,393	10	309,385
Florida	6	(5)	7	370,078	8	459,369
Georgia	15	241,789	16	218,463	16	232,005
Louisiana	6	462,049	6	420,495	6	419,866
Maryland	6	(5)	6	911,543	6	995,138
Mississippi	3	(5)	3	21,191	3	20,118
North Carolina	9	(5)	9	155,159	9	163,446
South Carolina	9	165,981	10	212,704	10	204,203
Texas	8	(5)	8	613,447	9	880,330
Virginia	12	(5)	12	540,502	12	486,720
Kentucky and Tennessee	4	(5)	4	774,042	5	795,728
Other[6]	5	4,008,184	6	605,650	7	615,861
Total South	93	5,062,336	97	5,150,667	101	5,582,169
West[7]	15	827,380	15	736,217	14	709,849
Total United States[8]	180	10,780,166	186	10,736,935	187	10,726,976

[1] Revised figures.
[2] Includes data for plants located as follows: Connecticut 1; Maine 1; Massachusetts 2; Rhode Island 1.
[3] Includes data for plants located as follows: New Jersey 10; New York 3.
[4] Includes data for plants located as follows: Iowa 1 (none in 1947); Missouri 2; Wisconsin 2 (1 in 1947).
[5] Included with "Other."
[6] Includes data from plants located as follows: Arkansas 1 (2 in 1949); Delaware 1; Oklahoma 2; West Virginia 2 (1 in 1947).
[7] Includes data from plants located as follows: Arizona 2; California 8 (7 in 1949); Colorado 1; Montana 1; Utah 1; Washington 1; Wyoming 1.
[8] Includes processing plants as follows: 1947—82 contact units, 85 chamber units, and 10 plants operating both types of units; 1948—91 contact units, 85 chamber units, and 9 plants operating both types of units; 1949—94 contact units, 83 chamber units, and 10 plants operating both types of units.

The role and value of sulfur in soil fertility were the subjects of a symposium.[8] The use of sulfur in the ceramics industry was outlined,[9] and a brief publication on sulfuric acid was issued by the United States Department of Commerce.[10]

STOCKS

On December 31, 1942, the combined total of all producer-owned stocks was reported to be 5,114,000 long tons. This included stocks held at the mine, in transit, and at various other locations. Of the total, 4,300,000 tons were in stock at the mine. Since that date stocks have declined steadily, as demand has consistently exceeded supply. At the end of 1949 the total producers' stocks had been reduced to 3,099,305 long tons, of which 2,650,152 long tons were at the mines.

PRICES

The price of crude sulfur remained at $18 per long ton f. o. b. mines for the domestic market and $22 f. o. b. Gulf ports, for export, throughout 1949.

FOREIGN TRADE

As shown in the accompanying table, the United States imports little or no crude sulfur. However, small quantities of sulfur ore are reported to be imported from Mexico into southern California for use in treating soil.

Exports, on the other hand, which averaged about 583,000 long tons in 1935 to 1939, have increased until a record total of 1,460,967 tons was reached in 1949.

Gulf coast sulfur is the preferred raw material in most areas throughout the world both for quality and price reasons. The accompanying table shows the wide distribution of American sulfur in the world market.

Sulfur imported into and exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Imports				Exports			
	Ore		In any form, n. e. s.		Crude		Crushed, ground, refined, sublimed, and flowers	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
1945			33	$10,197	918,691	$16,643,121	23,971	$1,634,943
1946	(1)	$20	35	11,226	1,189,072	21,589,966	56,748	2,624,873
1947			15	5,014	1,299,060	25,388,093	50,477	2,318,956
1948			38	13,299	1,262,913	26,779,444	32,630	1,774,358
1949	5	89	27	5,768	1,430,916	30,489,876	30,051	1,682,965

[1] Less than 1 ton.

[8] Chemical and Engineering News, Sulfur in Agriculture: Vol. 27, No. 41, October 10, 1949, p. 2914.

[9] Ceramic Industry, vol. 52, No. 1, January 1949, p. 145.

[10] Tremearne, T. H., Sulfuric Acid (Synopsis of Information): Chemicals Division, Office of Domestic Commerce, Department of Commerce, Washington, D. C., February 1949, 8 pp.

Sulfur exported from the United States, 1948–49, by countries

[U. S. Department of Commerce]

Country	Crude				Crushed, ground, refined, sublimed, and flowers			
	1948		1949		1948		1949	
	Long tons	Value	Long tons	Value	Pounds	Value	Pounds	Value
North America:								
Canada	304,228	$6,050,327	240,018	$4,697,980	6,927,472	$199,240	5,860,886	$172,873
Newfoundland-Labrador	14,240	255,450	13,385	258,508				
Central America	105	2,700	81	2,546	757,894	30,993	595,467	21,352
Mexico	2,201	51,899	3,149	90,109	5,148,961	111,347	8,349,777	194,865
West Indies	23,822	507,284	35,750	701,764	445,181	20,172	116,179	6,209
Total North America	344,596	6,867,660	292,383	5,750,907	13,279,508	361,752	14,922,309	395,299
South America:								
Argentina	43,269	943,468	15,043	330,946	44,700	10,696	126,618	23,242
Brazil	30,141	672,261	47,238	1,060,057	5,882,110	220,391	5,198,692	181,499
Colombia	1,055	33,686	290	9,332	590,083	15,838	601,502	36,295
Ecuador	69	2,449	100	3,100			383,033	10,309
Peru					941,673	49,814	2,676,218	81,050
Uruguay	4,165	90,297	4,500	99,000	400	136	107,100	2,710
Venezuela	3	230	56	1,898	552,576	12,382	91,298	3,904
Other South America					16,050	603	10,600	1,261
Total South America	78,702	1,742,391	67,227	1,504,333	8,027,592	309,860	9,195,061	340,270
Europe:								
Austria	3,180	104,940	10,022	220,484				
Belgium-Luxembourg	76,889	1,692,748	85,932	1,783,046	788,057	14,624	395,187	8,784
Czechoslovakia	12,500	288,750						
France	69,880	1,532,760	150,891	3,355,082	31,350	7,620	3,350	244
Germany	16,844	384,871	27,440	606,832	472,625	8,031	3,500	950
Greece					13,727,227	207,362	54,860	1,456
Netherlands	7,018	154,880	1,500	33,000	943,740	17,194	1,733,931	30,789
Norway			19	912	130,836	2,670	3,000	113
Portugal	700	18,900	198	4,900	113,612	4,008	3,300	528
Spain					7,950	1,710	8,700	1,871
Sweden	15,184	333,349	9,690	213,180	288,500	11,865	241,149	6,086
Switzerland	28,034	616,748	17.400	382.800	395,611	14,028	515,324	19,847
United Kingdom	345,312	7,215,977	393,511	8,337,931	3,550	728		
U. S. S. R.	400	9,600						
Other Europe	7,028	153,900	3,500	77,000	2,250	495	450	113
Total Europe	582,969	12,507,423	700,103	15,015,167	16,905,308	290,335	2,962,751	70,781

Asia:								
Ceylon					1,057,200	22,349	100,045	2,251
China	1,711	58,629	652	18,676	7,296,360	145,925	2,084,619	58,085
French Indochina					27,000	810		
Hong Kong	298	7,993	4,524	109,185	2,617,080	48,304	23,849,980	435,810
India	35,267	802,594	37,234	845,117	10,710,309	233,406	7,551,619	167,057
Indonesia			4,250	93,500	157,341	3,811	199,954	6,048
Iran	8,379	216,417	15,965	397,812				
Israel-Jordan	614	15,378	2,540	64,213	2,240,108	33,691	2,264,872	48,477
Korea	440	25,276	984	33,945	4,143,900	134,067	174,890	5,423
Lebanon					595,215	8,902	43,600	1,036
Pakistan					122,907	2,891	838,214	29,079
Philippines			4	376	74,960	7,166	120,984	8,094
Syria					54,615	1,169		
Other Asia	1,608	44,186	1,195	33,436	494,169	20,991	79,650	4,772
Total Asia	48,317	1,170,473	67,348	1,596,260	29,591,164	663,482	37,308,427	766,132
Africa:								
Algeria	10,500	231,000	14,270	313,940				
Angola					65,478	1,500	87,784	2,090
Belgian Congo					12,000	468	152,922	3,725
French Morocco			4,860	106,920				
Madeira Islands					44,000	2,090	44,000	1,870
Mauritius and dependencies					821,975	23,184		
Mozambique	223	8,456	149	41,071	708,344	13,322	315,460	8,073
Tunisia	2,000	44,000	1,360	29,920				
Union of South Africa	42,348	858,368	65,097	1,323,950	3,348,390	92,322	1,985,469	78,386
Total Africa	55,071	1,141,824	85,736	1,815,801	5,000,187	132,886	2,585,635	94,144
Oceania:								
Australia	103,229	2,255,063	146,419	3,230,008	62,110	3,519	77,800	5,467
New Zealand	50,029	1,094,610	71,700	1,577,400	225,304	12,524	262,850	10,872
Total Oceania	153,258	3,349,673	218,119	4,807,408	287,414	16,043	340,650	16,339
Grand total	1,262,913	26,779,444	1,430,916	30,489,876	73,091,173	1,774,358	67,314,833	1,682,965

WORLD REVIEW

As shown in the accompanying table, native sulfur is produced in a considerable number of countries; but individual output generally is comparatively small, and most of the production is concentrated in a few countries. The bulk of the tonnage comes from dome deposits that can be mined by the Frasch process in the Gulf Coast area of the United States. It is estimated that in 1949 the world output of native sulfur approximated 5,200,000 long tons—a tonnage nearly as great as the record established in 1948. The trend noted in recent years toward increasing use of elemental sulfur from sources other than natural sulfur deposits is continuing. The tonnage obtained from such operations is already quite appreciable. It is estimated that the total world sulfur production, including elemental sulfur derived from other sources as well as native sulfur, approximated 5,400,000 long tons in 1949.

World production of native sulfur, by countries,[1] 1944–49, in long tons

[Compiled by Helen L. Hunt]

Country [1]	1944	1945	1946	1947	1948	1949
Argentina	11,092	9,072	[2] 13,000	[2] 13,000	(3)	9,842
Bolivia (exports)	6,151	640	468	2,275	2,707	4,398
Chile	30,250	28,617	15,185	11,717	13,258	(3)
China (Formosa only)	230	34	280	508	1,719	344
Ecuador	13	102	26	23	43	16
France (content of ore)	1,021	2,672	2,083	8,427	13,779	(3)
Greece	1,860	----------	1,000	----------	(3)	(3)
Italy (crude)[4]	76,081	73,990	140,765	146,310	170,904	[2] 187,000
Japan	75,339	37,333	21,046	28,670	39,962	61,493
Mexico	[5] 5,100	[5] 7,100	(3)	3,200	2,100	(3)
Peru	1,316	1,197	363	779	971	271
Spain	6,280	4,840	4,000	3,600	2,500	5,000
Turkey (refined)	3,348	4,088	2,970	2,611	2,369	2,995
United States	3,218,158	3,753,188	3,859,642	4,441,214	4,869,210	4,745,014
Total (estimate)	3,500,000	4,000,000	4,200,000	4,800,000	5,300,000	5,200,000

[1] Native sulfur believed to be produced also in China (continental), Cuba, Egypt, Guatemala, India, Indonesia, Iran, Israel-Jordan, and U. S. S. R., but complete data are not available; estimates by senior author of chapter included in total.
[2] Estimate.
[3] Data not available; estimate by author of chapter included in total.
[4] In addition, 32,025 tons of sulfur rock were reported in 1944. Similar data not available for later years.
[5] Incomplete data.

Bolivia.—Bolivia produces a few thousand tons of sulfur annually, principally for export. Sulfuric acid requirements of Bolivia are small, but it was reported that a new sulfuric acid plant to supply the most essential needs was completed in 1949.[11]

China (Formosa).—Before World War II there were about 15 producing mines in the Taipei-Keelung area. During the war the mines continued to operate, but the production figures are not precise. Prewar exports, as reported by the prewar operator of the mines, are said to have been about 100 tons monthly to Shanghai, total production being apparently of the order of 150 tons monthly. Current production was estimated to be 200 to 300 tons monthly, some portion of which was being exported before October 1948, when exports were prohibited by the Provincial Government. Local consumption

[11] Chemical and Engineering News, Bolivian Sulfuric Acid Plant: Vol. 27, No. 28, July 11, 1949, p. 2018.

requirements exceed production capacity. The deposits were said to be small and scattered, the ore containing 20 to 80 percent sulfur. Processing equipment is said to consist of large cast-iron pans, in which the ore is heated, and distillation apparatus to draw off the sulfur.[12]

Colombia.—It was reported that Industrias Purace is exploiting a 6,000,000-ton deposit of sulfur on the Purace Volcano in Cauca Department, Colombia.[13]

France.—The Société Languedocienne de Recherches et d'Exploitations Miniéres is producing native sulfur in southwestern France from a deposit that is relatively lean but is located advantageously with regard to the market, particularly the grape industry. Before 1949 the product commonly contained 10 to 30 percent sulfur, which served as a reasonably satisfactory insecticide and fungicide; but, as a higher-quality material was in demand, improved beneficiation processes have been installed. New flotation and milling methods are being applied to beneficiate the product, and it was reported that purities of 90 and 97 percent were being achieved. The product is comparatively expensive, but the company anticipates that its costs will be reduced to a point that will make it competitive with foreign sulfur in the not too distant future.

Italy.—Italy's mining industry is easily able to supply domestic consumption requirements, which are increasing, and also provide a large exportable surplus of sulfur. As the Italian producers of native sulfur are using methods that are expensive as compared to the Frasch process, they are at a serious disadvantage in the world market; consequently, the Italian sulfur industry has been in a depressed condition in recent years. The industry is subsidized to some degree by the Government, and special efforts are made by a central marketing organization to market production, particularly that from Sicily, in foreign countries. For example, it was reported in the press that the organization contracted to ship 6,000 metric tons of refined sulfur to Greece in exchange for tobacco; that France had agreed to take 30,000 tons of crude sulfur, paid for within the framework of the French-Italo clearing agreement; and that 7,000 metric tons of crude sulfur went to Soviet Russia.[14]

During 1949 Italian sulfur production apparently increased moderately but stocks were large.

Some efforts are being made to improve the mining practices, which in many instances are very primitive, and also to introduce better beneficiation methods. Arrangements have been made for installing a pilot plant designed to beneficiate sulfur by flotation. It is anticipated that this method will be more efficient than the methods now practiced. The experiment is being carried on at the Cozzo Disi mine, and construction was scheduled for completion in 1950. If it is successful, the method could be applied at a number of Sicilian mines where adequate water and power are available. In 1949 it was said that the price of Italian sulfur was of the order of $45 to $50 a ton, considerably above the delivered cost of American sulfur in the

[12] Scott, George, Consular Rept. 5, Taipei, Formosa, March 30, 1949.
[13] Engineering and Mining Journal, vol. 150, No. 12, December 1949, pp. 130–131.
[14] Oil, Paint and Drug Reporter, vol. 155, No. 12, March 21, 1949, p. 43.

European area. The aim, therefore, is to reduce costs by 50 percent or more to improve the competitive position.

A Government decree dated July 9, 1949, established the following prices to be paid for sulfur placed by producers at the disposal of Ente Zolfi Italiani: Superior Yellow, 34,800 lire ($60.52); Inferior Yellow, 33,900 ($58.95); Good, 33,000 ($57.39); and Ordinary, 32,400 ($56.34). These figures were higher than those established a year previously because of rising production costs.[15]

During the year there were reports that sulfur producers in Sicily felt that special commercial arrangements enabling them to compete in various markets would be desirable, but in the United States the Sulphur Export Corporation denied that such an agreement with Italian sulfur producers was contemplated.

Japan.—Installation of sulfuric acid plants that would recover sulfur compounds from sinter gases was planned by the Nippon Mining Co. Hitachi and Saganoseki copper smelters, Dowa Mining Co. Kosaka smelter, Mitsubishi Mining Co. Osarizawa smelter, and others.[16]

Mexico.—The sulfur industry was very active in Mexico in 1949. Actual mining of sulfur (from shallow deposits) was very small, but several companies were conducting exploration programs in an attempt to locate domes that could be mined by the Frasch method.

The Gulf Sulphur Co. de Mexico, S. A., an affiliate of the Pan American Sulphur Co., conducted an extensive drilling program in the vicinity of Jaltipan, Vera Cruz.

The Mexican Gulf Sulphur Co. drilled the San Cristobol Dome in the State of Vera Cruz, Mexico, and the drilling record was being analyzed by the Jefferson Lake Sulphur Co. under an agreement between the two companies.[17]

Cia Exploridora de Istmo, a Mexican subsidiary of the Texas Gulf Sulphur Co., entered into an agreement with the Republic of Mexico which grants exploitation and mining rights in the State of Vera Cruz. Geophysical and surveying operations were begun as a preliminary to the selection of areas for exploratory drilling.[18]

Turkey.—A new shaft has been sunk to the ore body at the Keciburlu sulfur mine in Turkey. The deposit is said to be very large.

PYRITES

DOMESTIC PRODUCTION

Pyrites production in the United States declined slightly—4 percent in 1949—but, as shown in the accompanying table, it remained close to record levels.

The price and quality of native sulfur produced in the United States are such that, to compete, pyrites must have local advantages such as low shipping costs of either the raw material or the acid product. Virtually all of the pyrites produced in the United States is converted into sulfuric acid, much of it by the producing companies themselves. In 1949, producing companies consumed 726,777 long tons in acid manufacture and sold 141,484 long tons.

[15] Consular Rept. 173, American Embassy, Rome, Italy, Aug. 26, 1949, 3 pp.
[16] Mining World, vol. 11, No. 9, August 1949, p. 57.
[17] Jefferson Lake Sulphur Co., Annual Report, 1949.
[18] Texas Gulf Sulphur Co., Annual Report, 1949.

Pyrites (ores and concentrates) produced in the United States, 1945–49

Year	Quantity		Value	Year	Quantity		Value
	Gross weight (long tons)	Sulfur content (percent)			Gross weight (long tons)	Sulfur content (percent)	
1945	722,596	41.0	$2,700,000	1948	928,531	41.8	$3,950,000
1946	813,372	41.5	3,228,000	1949	888,388	42.6	3,904,000
1947	940,652	41.7	4,070,000				

California.—The Hornet Mine of the Mountain Copper Co. produced a large tonnage of pyrites in Shasta County, Calif.

Colorado.—Output of pyrites in Colorado was reported by the Rico Argentine Mining Co., Dolores County; the Empire Zinc Division of the New Jersey Zinc Co., Eagle County; and Climax Molybdenum Co., Lake County. Production from the State totaled 13,877 long tons valued at $50,498.

Indiana.—A total of 559 tons of pyrites (coal brasses) was recovered by the Snow Hill Coal Corp. from its coal washer at its Tallydale mine, Vigo County, Ind.

Montana.—Production of byproduct pyrites at the copper-plant operations of Anaconda Mining Co., Anaconda, Deer Lodge County, increased sufficiently to make Montana the third-largest producing State in 1949.

New York.—Pyrites output at the Balmat mine of St. Joseph Lead Co. in St. Lawrence County, N. Y., increased during 1949.

Pennsylvania.—The Bethlehem Steel Co. produced pyrites at its concentrator in Lebanon County, Pa.

Tennessee.—Tennessee was again, by a wide margin, the leading pyrites-producing State. Production came from the mines of the Tennessee Copper Co. in the Ducktown area, Polk County. The pyrites concentrate was used by the company in the production of sulfuric acid and sinter.

Virginia.—The second-largest producing State in 1949 was Virginia. Output came from the Gossan mine of the General Chemical Division, Allied Chemical & Dye Corp., in Carroll County. The company uses pyrites from this mine for its sulfuric acid plant at Pulaski.

Wisconsin.—Recovery of pyrites is reported to have been discontinued by the Vinegar Hill Zinc Co.

PRICES

There is considerable variation in the f. o. b. mine prices of pyrites produced in the United States, because transportation costs and other local conditions vary considerably. The range in 1949 is reported to have been from less than $1.25 to about $6.00. The average value of total production was reported by producers to be $4.40. The average of the total sales was $5.23 per ton. Oil, Paint and Drug Reporter quoted Spanish pyrites at $8 per ton c. i. f. Atlantic ports. E&MJ Metal and Mineral Markets quoted nominal prices of Spanish pyrite at 14 to 16 cents per long-ton unit of sulfur delivered to United States ports.

Pyrites valuation is sometimes deceptive because of allowances made for recoverable nonferrous metal values in the ore. Sources in the industry estimate that Spanish pyrites was worth, for its sulfur content, approximately 15 cents per unit during 1949.

FOREIGN TRADE

The United States does not export pyrites, but historically it has been a substantial importer. However, in recent years imports have declined greatly; whereas in 1935–39 pyrites imports averaged 433,485 long tons, total receipts in 1949 were only 120,937. Spain, which before World War II was the major source of supply, sold less than 13,000 tons in the United States during 1949. Canada is now the principal source. Total imports, which had declined to 107,411 long tons in 1948, increased 13 percent in 1949.

The market for foreign pyrites is largely centered in the East; nearly the entire tonnage entered through the Buffalo and Philadelphia customs districts.

Pyrites, containing more than 25 percent sulfur, imported for consumption in the United States, 1945–49, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947		1948		1949	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Canada	137,238	$276,832	121,807	$269,179	85,094	$266,698	75,248	$169,551	107,951	$215,290
Mexico	57	160								
Norway	1,150	1,725								
Portugal					300	2,664				
Spain	48,062	133,900	61,086	170,053	41,159	106,136	32,163	89,994	12,986	36,331
Total	186,507	412,617	182,893	439,232	126,553	375,498	107,411	259,545	120,937	251,621

Pyrites, containing more than 25 percent sulfur, imported for consumption in the United States, 1945–49, by customs districts, in long tons

[U. S. Department of Commerce]

Customs district	1945	1946	1947	1948	1949
Buffalo	127,765	121,807	36,610	66,385	106,862
Connecticut			34	37	
Galveston	19				
Michigan	9,414				
New York			300		
Ohio	5				
Philadelphia	49,212	61,086	89,609	40,989	14,075
San Diego	38				
Washington	54				
Total	186,507	182,893	126,553	107,411	120,937

WORLD REVIEW

Alhtough in the United States pyrite deposits are at present the secondary source of supply of sulfur, they occupy an important place in the world supply. World output declined during World War II; but, as shown in the accompanying table, the total has increased steadily since 1945 and is now back at about the prewar level. Reports

World production of pyrites (including cupreous pyrites), by countries,[1] 1945–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1945		1946		1947		1948		1949	
	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content
Algeria	29,280	[2] 11,900	40,360	16,505	35,295	14,475	35,900	14,360	32,385	[2] 13,000
Australia:										
New South Wales	(3)	(3)	14,439	6,930	22,353	10,729	7,773	3,762	[4] 2,591	[4] 1,211
Tasmania	40,813	20,000	37,893	18,570	52,351	26,175	44,973	22,487	[4] 32,423	[4] 16,212
Western Australia	67,571	(3)	79,032	15,091	45,049	19,314	38,102	15,981	[4] 22,712	[4] 9,419
Austria	2,180	800	3,823	1,332	6,139	2,047	7,871	2,942	11,672	[2] 4,000
Brazil	(3)	(3)	(3)	(3)	3,600	[2] 1,500	3,600	[2] 1,500	(3)	(3)
Canada	206,586	99,974	183,191	87,577	161,718	74,967	166,985	79,039	226,958	106,448
China	(3)	(3)	(3)	(3)	64,876	29,200	42,907	19,300	(3)	(3)
Cyprus	36,790	17,179	294,052	141,145	611,800	293,664	589,772	283,091	942,808	452,548
Czechoslovakia	533	192	7,999	2,880	6,002	[2] 2,200	3,195	[2] 1,200	(3)	(3)
Finland	110,320	48,541	126,310	55,627	152,268	66,891	177,512	79,170	(3)	(3)
France	168,145	67,765	218,510	86,597	196,180	[2] 78,500	179,000	68,000	(3)	(3)
French Morocco	(3)	(3)	(3)	(3)	(3)	(3)			200	(3)
Germany	[5] 73,000	(3)	238,700	[2] 85,000	[6] 321,000	[6] 128,400	[6] 383,100	[6] 153,245	430,495	176,362
Greece	6,510	3,125	80,140	38,467	58,185	28,000	16,236	[2] 7,800	15,785	[2] 7,600
Italy	108,342	47,335	400,519	[2] 184,300	642,445	[2] 295,500	835,027	[2] 384,100	866,179	[2] 398,400
Japan	[7] 118,750	[7] 51,063	474,842	204,182	832,845	349,795	1,138,782	489,676	1,535,082	660,085
Korea	62,064	[2] 24,800	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Norway	247,465	106,369	539,850	232,710	720,015	310,079	735,422	[2] 312,400	745,367	[2] 316,800
Poland	(3)	(3)	28,253	[2] 11,300	39,659	[2] 15,900	(3)	(3)	(3)	(3)
Portugal	170,967	[2] 76,900	314,976	[2] 141,740	388,827	174,972	561,136	[2] 252,500	622,925	[2] 280,300
Rumania	(3)	(3)	4,873	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Southern Rhodesia	33,465	[2] 13,390	25,413	[2] 10,160	17,144	[2] 7,115	13,224	[2] 5,500	16,968	6,787
Spain	899,760	[2] 377,900	1,175,976	[2] 493,910	1,217,442	[2] 511,300	1,463,912	[2] 614,800	1,132,793	[2] 475,800
Sweden	261,984	131,096	280,208	136,781	310,571	147,602	392,033	181,987	(3)	(3)
Tunisia	460	200	2,775	1,275	6,345	2,855	3,220	[2] 1,400	2,920	[2] 1,300
Turkey			300	(3)	5,000	(3)	(3)	(3)		
Union of South Africa	38,556	16,745	38,044	16,553	34,820	15,166	35,992	15,456	35,527	[2] 15,200
United Kingdom	23,439	(3)	20,959	(3)	10,106	(3)	(3)	(3)	(3)	(3)
United States	734,194	301,000	826,427	342,967	955,749	398,975	943,434	394,583	905,746	385,518
Total (estimate)	5,000,000	2,100,000	7,000,000	3,000,000	8,700,000	3,700,000	9,500,000	4,000,000	10,500,000	4,400,000

[1] In addition to countries listed, Belgium, Egypt, Hungary, India, Iran, Ireland, U. S. S. R., Uruguay, and Yugoslavia produce or have produced pyrites, but production data are not available; estimates by senior author of chapter included in total. South Korea had no production 1946 through 1949.

[2] Estimate.

[3] Data not available; estimate by author of chapter included in total.

[4] January to September, inclusive.

[5] British zone only.

[6] Bizonal area.

[7] Preliminary data for fiscal year ended March 31 of year following that stated.

from producing countries are not yet complete, but it is estimated that total world output of pyrites in 1949 approximated 10,500,000 tons.

Australia.—Australia is a substantial consumer of sulfur; and, as elemental sulfur must be imported from abroad, there has been a more or less continuous effort to supplant the imported material with domestically produced pyrites. During 1949 efforts were made to use a large tonnage of pyrites available in several dumps of Mount Morgan, Ltd., in Queensland.[19]

There has been a shortage of acid in Australia, and more capacity is to be installed. Before approval, however, the raw-material problem was being given serious consideration, even to the extent of investigating the possibility of using gypsum.[20]

The devaluation of Australian currency was another factor that hastened plans to utilize Australia's own sulfur resources and also increased efforts to obtain sulfur from "soft-currency" sources.[21]

Canada.—As shown in the world production table, Canada is a substantial producer of pyrites. Reserves of this mineral are believed to be large. For example, one zone of the Noranda mine is said to contain 100,000,000 tons of pyrites ore.[22] Canada has no commercial production of native sulfur; its imports of native sulfur from the United States generally exceed a quarter of a million tons annually. This is a substantial market, and various efforts are being made to serve it from local raw material.

Some sulfur compounds are recovered from smelter gases in British Columbia. A project for extracting liquid sulfur dioxide at Sudbury, Ontario, was reported.[23] An experimental project was underway at Noranda looking toward production of elemental sulfur and iron sinter from pyrites.

Germany.—Germany, as a highly industrialized country, requires large quantities of sulfur minerals. During World War II its needs were satisfied in part by expanding the output of pyrites, particularly at the Meggen mine, where production exceeded a million tons in 1943. After the war, pyrite production in Germany dropped sharply and then recovered somewhat. Output of pyrite in Bizonia is reported to have exceeded 380,000 metric tons in 1948, of which about 300,000 tons were contributed by Meggen. Imports of pyrites in that year totaled 461,874 metric tons, most of which came from Spain and Norway.[24] In 1949 German pyrite production increased to 430,495 metric tons.

Discovery of a new deposit of pyrites has been reported near Elbingerode in the Harz Mountains in the Soviet Zone. Early opening of the new deposit was expected because of a shortage of pyrites in that area.[25]

[19] Engineering and Mining Journal, vol. 150, No. 1, Jan. 1949, p. 131.
[20] Chemistry and Industry (London), Acid Plant for Australia; No. 24, June 11, 1949, p. 388.
[21] Chemical Engineer, vol. 56, No. 12, Dec. 1949, pp. 207–208.
[22] Mining World, vol. 11, No. 9, Aug. 1949, p. 28.
[23] Mining Journal (London), vol. 233, No. 5948, Aug. 20, 1949, p. 763.
[24] Mining World, The Pyrite Industry of Bizonia and Its Place in the West German Economy; Vol. 11, No. 11, Oct. 1949, p. 42.
[25] Mining World, vol. 11, No. 3, Mar. 1949, p. 52.

Italy.—Italy has again developed enough pyrites production to have an exportable surplus. It was reported that in 1948, 83,000 tons were exported out of a total production of 835,000.[26]

Norway.—A/S Grong Gruver has indicated that its ore reserves total at least 20,000,000 tons of pyrites. Other deposits in Norway are said to be somewhat uncertain, but it is estimated that, after 20 or 30 years, the Norwegian output of pyrites will decline. This estimate may be modified by the expected development of the Skorovas mine to an annual rate of 150,000 tons a year and the possibility of further successful exploration both in known deposits and new ones.[27]

An extensive development program is being carried out by the Killingdal Mines in central Norway. Because of operating difficulties underground, annual output of this mine has declined from 49,000 to 30,000 tons. With the installation of more adequate underground transportation, as well as new surface facilities, it was anticipated that output will again be raised to the previous level.[28]

Portugal.—Pyrite production in Portugal increased moderately during 1949, and the exports improved owing in part to better availability of shipping space. A large part of Portugal's exports go to France.[29]

Southern Rhodesia.—It was reported that, up to the end of 1948, 319,398 tons of pyrites had been mined from the Iron Duke mine in the Mazoe district, Southern Rhodesia, which is the only one worked solely for pyrites. The pyrites are sent to the sulfuric acid plant at Rhodesia Broken Hill in Northern Rhodesia.[30]

Spain.—The pyrites industry of Spain has not recovered from the decline entered during World War II, but there has been some progress by both the Government and producers in expanding the output of this important export commodity. During 1949 the industry found operations very difficult owing to a serious shortage of electrical power caused by drought, shortages of operating equipment, and increasing operating costs caused in part by monetary inflation and foreign exchange difficulties. However, in spite of these difficulties, the Tharsis Sulphur & Copper Co., Ltd., increased its pyrites exports to 513,576 tons—slightly more than in 1948. Total production in Spain increased to 1,132,793 tons in 1949 but was still far below the prewar normal.

United Kingdom.—It was reported that peak production of pyrites from colliery refuse totaled 25,000 tons per year. The pyrites contained 42 percent sulfur, 4 to 9 percent carbon, and 0.03 to 0.08 percent arsenic. It was blended with imported pyrites for burning in Herreshoff furnaces.[31]

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[26] Chemistry and Industry (London), No. 40, Oct. 1, 1949, p. 695.
[27] Mining World and Engineering Record, Pyrite Mines of Norway: Vol. 156, No. 4064, Feb. 19, 1949, p. 102.
[28] Mining World, Expansion Is Planned at Norway Pyrite Mines: Vol. 11, No. 9, Aug. 1949, p. 230.
[29] Oil, Paint and Drug Reporter, vol. 155, No. 23, June 6, 1949, p. 45.
[30] Mining World and Engineering Record, vol. 157, No. 4089, Aug. 13, 1949, p. 98.
[31] British Abstracts, B–I, Sept. 1948, p. 465.

Talc and Pyrophyllite

By Bertrand L. Johnson and F. M. Barsigian

GENERAL SUMMARY

MINE production of talc, pyrophyllite, and ground soapstone, and the quantity and value of these commodities sold or used, all decreased in 1949. (See fig. 1). Total imports were slightly higher in quantity in 1949 than in 1948, and considerably higher in value. Exports of crude and ground talc, steatite, soapstone, and pyrophyllite decreased in quantity and increased in value. Exports of talcum powders were again cut sharply, decreasing from $2,228,956 in 1948 to $1,633,046 in 1949.

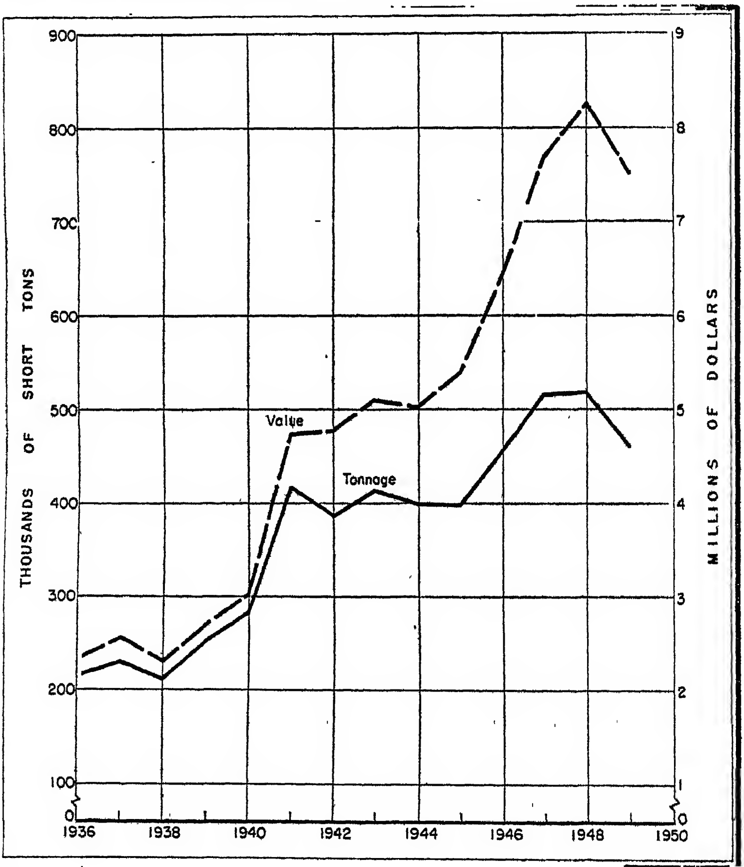

FIGURE 1.—Sales of domestic talc, pyrophyllite, and ground soapstone, 1936–49.

Salient statistics of the talc, pyrophyllite, and ground-soapstone industries in the United States, 1948–49

	1948		1949	
	Short tons	Value	Short tons	Value
Mined [1]	528,543	(2)	459,345	(2)
Used by producers	481,424	(2)	415,575	(2)
Sold by producers:				
Crude [1]	49,124	$408,186	49,706	$435,571
Sawed and manufactured	920	227,963	636	253,704
Ground	468,702	7,629,214	[3] 411,554	[3] 6,834,203
Total sales	518,746	8,265,363	461,896	7,523,478
Imports for consumption: [4]				
Crude and unground	85	4,835	58	8,267
Cut and sawed	98	29,133	110	31,786
Ground, washed, or pulverized	18,194	484,857	18,648	537,061
Total imports	18,377	518,825	18,816	577,114
Exports:				
Talc, steatite, soapstone, and pyrophyllite, crude and ground	16,327	432,176	[5] 15,841	[5] 440,141
Powders—talcum (in packages), face, and compact	(2)	2,228,956	(2)	1,633,046
Total exports		2,661,132		2,073,187

[1] Includes pinite; none in 1949.
[2] Figure not available.
[3] Includes a small quantity of crushed material.
[4] Exclusive of "Manufactures, n. s. p. f., except toilet preparations," as follows: 1948: $14,772; 1949: $9,012. Quantities not available.
[5] Includes manufactures, n. e. s.

Attention was called to the great variability in the chemical and mineralogical composition of commercial talcs.[1]

PRODUCTION AND SALES

The quantity of domestic talc, pyrophyllite, and ground soapstone sold or used in 1949 (461,896 short tons, valued at $7,523,478) was much less, in both quantity and value, than in 1948 or in 1947, according to reports of the producers to the Bureau of Mines, and the 1948 figures remain the all-time highs.

Talc, pyrophyllite,[1] and ground soapstone sold by producers in the United States, 1945–49, by classes

Year	Crude [1]			Sawed and manufactured		
	Short tons	Value at shipping point		Short tons	Value at shipping point	
		Total	Average		Total	Average
1945	35,979	$367,488	$10.21	733	$182,904	$249.53
1946	36,963	348,484	9.43	756	227,751	301.26
1947	47,925	389,535	8.13	1,018	239,407	235.17
1948	49,124	408,186	8.31	920	227,963	247.79
1949	49,706	435,571	8.76	636	253,704	398.91

See footnote at end of table.

[1] Ladoo, R. B., and Stokes, C. A., Industrial Mineral Economics and The Raw Materials Survey: Paper delivered before the Industrial Minerals Division, Am. Inst. Min. and Met. Eng., Feb. 14, 1949, San Francisco, Calif., 10 pp.

Talc, pyrophyllite,[1] and ground soapstone sold by producers in the United States, 1945–49, by classes—Continued

Year	Ground			Total		
	Short tons	Value at shipping point		Short tons	Value at shipping point	
		Total	Average		Total	Average
1945	361,672	$4,856,843	$13.43	398,384	$5,407,235	$13.57
1946	419,347	5,869,109	14.00	457,066	6,445,344	14.10
1947	467,151	7,053,539	15.10	516,094	7,682,481	14.89
1948	468,702	7,629,214	16.28	518,746	8,265,363	15.93
1949	[2] 411,554	[2] 6,834,203	[2] 16.61	461,896	7,523,478	16.29

[1] Includes pinite; no sales in 1945–46 and 1949.
[2] Includes a small quantity of crushed material.

Pyrophyllite [1] produced and sold by producers in the United States, 1945–49

Year	Production (short tons)	Sales					
		Crude		Ground		Total	
		Short tons	Value	Short tons	Value	Short tons	Value
1945	77,716	6,215	$38,166	71,379	$613,034	77,594	$651,200
1946	97,765	10,716	85,002	85,835	913,301	96,551	998,303
1947	108,450	6,204	27,626	97,536	1,135,100	103,740	1,162,726
1948	107,885	5,175	25,766	102,152	1,313,266	107,327	1,339,032
1949	90,920	5,927	31,489	82,934	1,070,838	88,861	1,102,327

[1] Exclusive of pinite.

REVIEW BY STATES

In 1949 New York was still the leading producer by a large margin, North Carolina second, and California third. Sales in all the listed States except Nevada were lower in 1949 than in 1948. Sales of pyrophyllite, most of which comes from North Carolina, decreased markedly.

Talc, pyrophyllite, and ground soapstone, sold by producers in the United States, 1948–49, by States

State	1948		1949	
	Short tons	Value	Short tons	Value
California	98,681	$1,773,764	83,359	$1,434,046
Georgia	53,602	624,694	49,338	580,405
Maryland and Virginia	40,276	341,875	32,256	268,423
Nevada [1]	8,019	107,730	8,837	147,148
New York	119,716	2,613,935	115,636	2,658,774
North Carolina	104,052	1,455,691	86,208	1,344,767
Vermont	70,922	1,014,718	64,508	788,341
Other States [2]	23,478	332,956	21,754	301,574
Total	518,746	8,265,363	461,896	7,523,478

[1] Includes pinite; no sales in 1949.
[2] Montana, Texas, and Washington.

California.—California talc deposits have been described in recent articles.[2] The principal talc resources of both California and Nevada are confined to a southeasterly trending belt, 200 miles long and 30 miles in average width, in southeastern California. A second talc- and soapstone-bearing belt comparable in size and trend to this lies within the western foothills of the Sierra Nevada. Commercial production has come principally from the southeastern belt, where both steatitic and tremolitic talcs occur. Production from the western area has been comparatively small.

Montana.—The talc deposits of Montana at present of commercial ranks lie in altered limestones of pre-Cambrian age in an area about 40 miles across between the Beaverhead and Madison Rivers in counties of the same names.[3] A small deposit occurs, however, in Cambrian rocks one mile south of Helena. Two talc mines have been operating in the former area—one on Axes Creek southeast of Dillon and one on Johnny Gulch south of Ennis. These and a deposit of pyrophyllite near Argenta, 12 miles northwest of Dillon, are described in the report.

New York.—An interesting paper on the New York talc deposits appeared in 1949.[4] These occur near Gouverneur in the northwestern part of the pre-Cambrian Adirondack Mountain massif. All are of pre-Cambrian age and occur in the highly deformed, recrystallized Grenville marble. In these so-called talcs the mineral talc is reported to be subordinate in quantity to other minerals present in the deposits, and in the Gouverneur district it comprises less than 25 percent of the mined and ground rock. Most of the rock mined is a tremolite or tremolite-anthophyllite schist somewhat altered to serpentine and talc. The Natural Bridge talcs include types high in serpentine, as well as complex aggregates of serpentine, talc, carbonates, and diopside. The approximate percentages of constituent minerals in various types of commercial talcs (industrial mineral aggregates) from the Gouverneur district are shown in one table, and the chemical analyses of industrial talcs mined in New York State in another. The geology of the deposits, the mining and milling methods, and uses of these New York talcs are also discussed in this article.

Texas.—Extensive deposits of soapstone and impure talc occur in the pre-Cambrian rocks of the Llano uplift area in central Texas. These are in the Packsaddle schists which surround the granites. Current operations are confined to producing finely ground soapstone for roofing paper coatings and as an ingredient in oil-well drilling muds. A relatively small percentage of this material might be advantageously used as a fluxing agent to reduce firing temperatures in

[2] Wright, L. A., California Talcs: Mining Engineering, January 1950, Trans. Am. Inst. Min. and Met. Eng., vol. 187, pp. 122–128.
Page, B. M., Some California Talcs of Steatite Grade: Min. and Ind. News, vol. 16, No. 1, 1948, p. 12.
Wright, L. A., The White Eagle Mine, an Example of the Steatitization of Granite (abs.): Bull. Geol. Soc. America, vol. 59, No. 12, 1948, p. 2.
California Department of Natural Resources, Division of Mines, Mineral Information Service, Talc: Vol. 2, No. 5, May 1, 1949, pp. 5–6.

[3] Perry, E. S., Talc, Graphite, Vermiculite, and Asbestos in Montana: Montana Bureau of Mines and Geology, Memoir 27, 1948, 44 pp.

[4] Engel, A. E. J., New York Talcs, Their Geological Features, Mining, Milling, and Uses: Mining Engineering, September 1949. Trans. Am. Inst. Min. and Met. Eng., vol. 184, pp. 345–348.

the production of heavy clay products.[5] Also, preliminary beneficiation tests indicate that a feasible concentrate of higher-quality talc from these deposits will burn to a more nearly white color. The Alfred Davis soapstone deposits in Gillespie County have been investigated by the Bureau of Mines.[6] In May and June 1947 two holes were core-drilled. Geographic and topographic maps, vertical sections and logs of the diamond-drill holes, and a table of analyses of samples, as well as a brief description and history of the property are included in the report.

Washington.—The talc, soapstone, and pyrophyllite deposits of Washington are described in two recent publications.[7]

CONSUMPTION AND USES

Six industries—paint, ceramics, rubber, insecticides, roofing, and paper—consumed 82 percent of the sales of domestically produced talc, pyrophyllite, and ground soapstone in 1949, according to reports from the producers. Decreases were reported in all of these leading industries from 1948. Sales for the minor uses listed—toilet preparations, foundry facings, and crayons—showed increases. The paint industry was the leading consumer, with 22 percent of the total; ceramics, with 20 percent, was second.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1948–49, by uses [1]

Use	1948		1949	
	Short tons	Percent of total	Short tons	Percent of total
Paint	108,505	21	100,097	22
Ceramics	107,907	21	94,665	20
Rubber	66,226	13	53,414	12
Insecticides	72,740	14	59,393	13
Roofing	54,990	11	44,184	10
Paper	32,430	6	25,294	5
Toilet preparations	7,431	1	8,429	2
Foundry facings	6,764	1	6,986	1
Crayons	400	(2)	561	(2)
Other uses [3]	37,995	7	47,277	10
Unclassified	23,358	5	21,596	5
Total	518,746	100	461,896	100

[1] Partly estimated. Includes pinite (none in 1949).
[2] Less than 0.5 percent.
[3] Refractory, textile, asphalt filler, plaster, plastics, and miscellaneous other uses.

[5] Pence, F. K., Ceramic Resources of Texas: Am. Ceram. Bull., vol. 28, No. 12, Dec. 15, 1949, pp. 492–494.
[6] McMillan, W. D., Investigation of the Alfred Davis Soapstone Deposits, Gillespie County, Tex.: Bureau of Mines Rept. of Investigations 4509, 1949, 9 pp.
[7] Glover, S. L., Importance of Industrial Minerals in the State of Washington: Western Miner, vol. 21, No. 3, 1948, pp. 50–51.
Valentine, G. M., Inventory of Washington Minerals. Part I. Nonmetallic Minerals: Washington Dept. of Conservation and Development, Division of Mines and Geol. Bull. 37, 1949, 113 pp.

PRICES

The average value per ton of domestic talc, pyrophyllite, and ground soapstone sold (or used by producers) rose from $15.93 in 1948 to $16.29 in 1949, an increase of 36 cents a ton.

Prices of ground talc and pyrophyllite, quoted by the Oil, Paint and Drug Reporter for weeks near the beginning, midyear, and end of 1949, are shown in the following table:

Prices quoted on talc and pyrophyllite, carlots, 1949–50, per short ton

[Oil, Paint and Drug Reporter]

Mineral and grade	Jan. 3, 1949	July 4, 1949	Jan. 1, 1950
GROUND TALC (BAGGED)			
Domestic, f. o. b. works:			
Ordinary:			
California	$22.00–$30.00	$22.00–$30.00	$25.00–$35.00
New York	21.00	(1)	(1)
Vermont	14.00	14.00	14.00
Fibrous (New York):			
Off color	24.00	24.00	24.00
325-mesh:			
88.95–99.05 percent	21.00	(1)	(1)
98–99.5 percent	23.00– 28.00	(1)	(1)
98.5–99.5 percent	(1)	23.00– 28.00	23.00– 28.00
Imported (Canadian)	35.00– 45.00	35.00– 45.00	12.50– 35.00
PYROPHYLLITE (BULK AT MINES) [2]			
Standard:			
200-mesh	11.00– 11.50	11.00– 11.50	11.00– 11.50
230-mesh	12.00	12.00	12.00
325-mesh	14.00	15.00	15.00
No. 3: 200-mesh	9.50	9.50	9.50
Insecticide grade: 200-mesh	9.00– 10.00	9.00– 10.00	12.00– 12.50
Rubber grade: 140-mesh	7.00	7.00	10.00– 10.50

[1] Not quoted.
[2] In paper bags, $3 to $3.50 per ton extra.

FOREIGN TRADE [8]

Imports.—Increases occurred in 1949 over 1948 in both quantity and value of total unmanufactured talc, steatite or soapstone, and French chalk imported for consumption in the United States—439 short tons in quantity and $58,289 in value, but imports of manufactures (n. s. p. f. except toilet preparations) declined in value from $14,772 in 1948 to $9,012 in 1949. As usual, the greater part of the unmanufactured imports was of the "ground, washed, powdered or pulverized, except toilet preparations" material. Most of the ground material came from Italy, with Canada in second place and France third. The manufactures came chiefly from China.

Imports of block steatite talc from India and Italy, both "crude" and "cut and sawed," partly satisfied the demand for block steatite talc, needed for the production of insulating materials in electronic apparatus by industry and for stockpiling by the Government. Stockpiling of imported block steatite talc for this purpose remains necessary because known domestic reserves of this type of talc are

[8] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

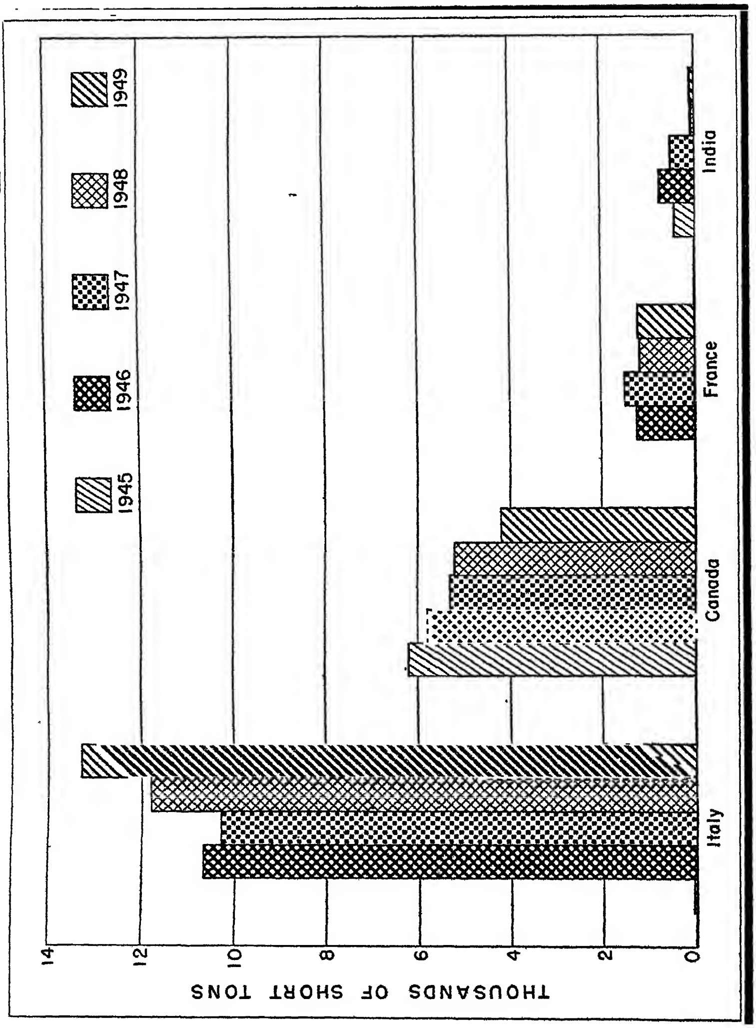

FIGURE 2.—Unmanufactured talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1945–49, by principal countries.

negligible and current production none and because it has not been satisfactorily shown that compressed ground steatite, of which the domestic supply is sufficient, can replace the block talc currently used for certain types of insulators. Preparations are in progress for comparative tests of electronic spacers made from both types of steatite by the United States Signal Corps, Rutgers University, and industry.

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, by classes in 1945–47, and by classes and countries in 1948–49

[U. S. Department of Commerce]

	Crude and unground		Ground, washed, powdered, or pulverized, except toilet preparations		Cut and sawed		Total unmanufactured		Manufactures, n. s. p. f. except toilet preparations (value)
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1945	385	$20,980	6,192	$63,260	122	$17,618	6,699	$101,858	$63
1946	8	530	18,407	394,881	34	4,856	18,449	400,267	15,687
1947	48	1,962	17,629	414,726	27	8,235	17,704	424,923	13,525
1948									
Belgium-Luxembourg			98	1,365			98	1,365	
Canada	45	518	5,165	64,030	4	168	5,214	64,716	23
China									13,674
Egypt	4	327					4	327	
France	(1)	5	1,146	19,345	5	1,225	1,151	20,575	999
Hong Kong									47
India	28	3,447	53	1,441			81	4,888	3
Italy			11,732	398,676	89	27,740	11,821	426,416	
Panama									8
Switzerland	2	247					2	247	
Union of South Africa	6	291					6	291	
United Kingdom									18
Total	85	4,835	18,194	484,857	98	29,133	18,377	518,825	14,772
1949									
Canada			4,166	51,150	13	1,885	4,179	53,035	
China									8,697
Egypt	4	333					4	333	
France			1,189	25,126	5	1,260	1,194	26,386	
Germany									6
Hong Kong									251
India	43	4,648	56	2,154			99	6,802	
Italy	11	3,286	13,237	458,629	82	25,808	13,330	487,723	58
Norway					10	2,833	10	2,833	
Sweden			(1)	2			(1)	2	
Total	58	8,267	18,648	537,061	110	31,786	18,816	577,114	9,012

[1] Less than 1 ton.

Exports.—The quantity of "talc, steatite, soapstone, and pyrophyllite, crude and ground" exported from the United States in 1949 dropped 487 short tons from 1948. The value of these exports, however, increased $7,510 to $439,686, a new record. The value of the exports of "powders—talcum (in packages), face and compact" decreased over half a million dollars ($595,910) in 1949 from the 1948 value.

Talc, pyrophyllite, and talcum powders exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Talc, steatite, soapstone, and pyrophyllite				Powders—talcum (in packages), face and compact (value)
	Crude and ground		Manufactures, n. e. s.		
	Short tons	Value	Short tons	Value	
1945	11,314	$280,590	(1)	(1)	$2,276,758
1946	16,373	394,799	(1)	(1)	3,517,827
1947	[2] 17,557	[2] 429,803	(1)	(1)	4,252,161
1948	16,327	432,176	(1)	(1)	2,228,956
1949	15,840	439,686	1	$455	1,633,046

[1] Not separately classified before January 1949.
[2] Excludes 599 short tons, valued at $30,589, sent to Japan under the Army Civilian Supply Program.

TECHNOLOGY

Several articles on the technology of talc have been published recently.[9] Of especial interest is the following statement by Bowen and Tuttle regarding the composition of talc, as shown by their studies in preparing synthetic talc:

> A number of chemical analyses of supposed talc in the literature have suggested to some investigators that talc can vary in composition, but present indications are that the materials examined were mixtures. In any case in our synthetic preparations, if we use a slight amount of silica over that indicated by the accepted formula, some free silica is present with the talc and if we use a slight excess of MgO some forsterite appears with the talc at 525° C. and 15,000 lb./in^2. Our work, therefore, does not support the concept of variability in the composition of talc and shows that the ratio of MgO and SiO_2 is that of the accepted formula ($3MgO \cdot H_2O \cdot 4SiO_2$). The water content is also in accord with that formula, analysis of our product showing 4.6 percent H_2O. The theoretical value is 4.75 percent.

A radio tube, reportedly superior to glass in producing small radio waves, has been developed by the General Electric Co. through using steatite for the tube body.

WORLD REVIEW

The production of talc, pyrophyllite, and ground soapstone in various countries in recent years is shown in the accompanying table.

[9] Gebler, K. A., and Wisely, H. R., Dense Cordierite Bodies: Jour. Am. Ceram. Soc., vol. 32, No. 5, May 1, 1949, pp. 163–165.
Bowen, N. L., and Tuttle, O. F., The System $MgO-SiO_2-H_2O$: Bull. Geol. Soc. America, vol. 60, March 1949, pp. 439–460
Ceramic Industry, Ceramic Materials. A Complete Dictionary: Vol. 52, No. 1, January 1949, pp. 75–149; pyrophyllite, p. 137; steatite, p. 144; talc, pp. 145–146.

World production of talc, pyrophyllite, and soapstone, by countries,[1] 1942–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1942	1943	1944	1945	1946	1947	1948	1949
Argentina	4,770	3,557	3,421	2,681	3,760	(2)	(2)	(2)
Australia:								
New South Wales	1,454	1,814	1,874	1,776	1,665	1,181	2,155	(2)
South Australia	2,577	3,336	3,930	3,037	3,727	4,532	3,936	(2)
Tasmania	----	----	4	155	50	----	22	(2)
Western Australia	308	74	266	----	396	216	73	(2)
Austria	42,933	57,639	44,628	4,470	21,600	24,500	47,300	52,144
Canada	27,096	23,735	29,571	24,574	26,628	24,230	26,109	25,198 (Canada and Newfoundland)
Newfoundland	1,580	2,439	224	711	660	220	(2)	
Chile	254	276	935	477	640	1,085	270	(2)
China	80,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Egypt	1,875	2,054	4,265	3,868	4,760	4,630	5,521	5,000
Finland	(2)	(2)	(2)	75	300	(2)	237	(2)
France	50,150	48,300	26,720	40,650	63,350	69,785	98,248	(2)
French Indochina	260	360	532	----	----	----	----	----
Germany	13,526	(2)	(2)	6,300	13,800	[3] 20,484	[4] 28,214	30,968
Greece	----	----	----	----	500	200	1,800	(2)
India	45,327	16,700	21,735	22,872	96,220	20,823	18,291	(2)
Italy	80,462	75,781	38,019	39,861	36,356	50,260	(2)	60,210
Japan	370,880	331,581	306,563	199,653	111,562	183,129	243,737	262,433
Kenya	(2)	63	123	202	490	297	322	590
Korea:								
North	4,121 (North and South)	[5] 35,370 (North and South)	1,200	[5] 12,152 (North and South)	(2)	(2)	(2)	(2)
South			40,011		300	700	72	2,773
Madagascar	(6)	39	(6)	----	----	----	(2)	(2)
New Zealand	15	63	25	----	----	----	----	(2)
Norway	34,933	35,514	[5] 21,559	15,522	31,062	37,687	60,226	(2)
Rumania	3,052	1,609	(2)	(2)	267	(2)	(2)	(2)
Spain [7]	36,497	14,238	10,470	19,319	30,665	31,616	29,984	38,208
Sweden	6,153	5,335	5,512	9,360	14,010	10,710	11,703	(2)
Union of South Africa	1,985	5,344	2,875	1,947	3,680	2,700	4,897	5,061
United Kingdom	2,231	2,815	2,829	2,170	3,437	3,379	(2)	2,621
United States [8]	351,952	374,546	361,841	361,406	414,641	468,190	470,596	419,023
Uruguay	4,588	1,985	2,257	1,823	1,818	2,675	2,984	660
Total (estimate)[1]	1,170,000	1,100,000	990,000	830,000	940,000	1,020,000	1,170,000	1,140,000

[1] In addition to countries listed, talc or pyrophyllite is reported produced in Brazil, Bulgaria, French Morocco, Pakistan, Tanganyika, and U. S. S. R., but data on production are not available; no estimate included in total.
[2] Data not available; estimate by author of chapter included in total.
[3] American zone only.
[4] Bizonal area.
[5] Incomplete.
[6] Less than 1 ton.
[7] Includes steatite as follows: 1942: 24,859; 1943: 9,741; 1944: 7,369; 1945: 15,577; 1946: 19,541; 1947: 20,835; 1948: 18,627; 1949: 20,880.
[8] Talc, pyrophyllite, pinite, and ground soapstone sold by producers.

Canada.—Preliminary reports show[10] that in 1949 Canada produced 13,500 short tons of talc (value $135,000) and 14,276 tons of soapstone ($123,599). Imports of talc and soapstone were given as 7,022 tons ($217,994) and exports of talc 3,854 tons ($49,357).

The Canadian talc and soapstone industry in 1948 was described as follows:[11]

> Canadian producers of talc and soapstone shipped 28,780 tons valued at $309,823 during 1948. Operators in Quebec, all in the Eastern Townships, shipped 14,479 tons of block and ground material worth $145,361 and shipments from Ontario totaled 14,301 tons valued at $164,462; the latter tonnage was mostly high-grade milled talc. The 5 concerns in this industry employed an average of 58 persons during the year.

[10] Canada, Department of Trade and Commerce, Dominion Bureau of Statistics, Preliminary Report on Mineral Production, 1949: Prepared in the Mining, Metallurgical and Chemical Section of the Industry and Merchandising Division, Dominion Bureau of Statistics, Ottawa, Canada (see p. 36).
[11] Canada, Department of Trade and Commerce, Dominion Bureau of Statistics, The Talc and Soapstone Industry in Canada, 1948: Industry and Merchandising Division, Mining, Metallurgical and Chemical Section, Ottawa, Canada, 1949, 4 pp.

Canadian consumers imported 7,798 tons of talc or soapstone valued at $213,438 in 1948. Exports totaled 5,052 tons worth $63,474.

Ground talc, including soapstone and pyrophyllite, is used chiefly in the paint, roofing, paper, rubber, insecticide, and ceramic industries. It is used also in foundry facings, bleaching fillers for textiles, cosmetics and pharmaceuticals, soaps and cleansers, plaster, polishes, plastics, and for rice polishing. Soapstone is used extensively in the form of sawn blocks and bricks for lining the alkali recovery furnaces and kilns of kraft pulp and paper mills. It is used for brick and slab liners for fireboxes, stoves, and ovens, and for switchboard panels, laboratory benches, etc. Considerable quantities of soapstone quarry and sawing waste are ground and used as low-grade talc in the rubber, roofing, foundry, and other trades. Compact, massive talc, sawn into square pencils and slices, is an important material for steelmakers' crayons. Recent shortages of suitable raw material have led to the introduction of extruded crayons compounded of ground talc with a suitable binder.

Consumption of ground talc and soapstone in Canada, by uses and Provinces, 1945–47, in short tons

	1945	1946	1947
USES			
Roofing	6,168	8,065	8,618
Paints	5,885	5,445	7,352
Rubber	2,656	2,529	3,075
Insecticides	943	2,616	2,388
Pulp and paper	2,454	2,872	1,899
Toilet and medicinal preparations	1,373	1,226	1,350
Imported clay products	713	1,107	1,214
Soaps and cleaning preparations	735	683	524
Electrical apparatus	199	259	330
Textiles	267	250	[1] 150
Iron foundries	106	106	[1] 106
Prepared foundry facings	10	17	39
Polishes	23	31	8
Adhesives	45	45	[1] 6
Linoleum		19	6
Plastics	10		
Total	21,587	25,270	[2] 27,115
PROVINCES			
Alberta	67	83	70
British Columbia	641	648	678
Manitoba	1,439	1,548	1,503
New Brunswick	475	375	509
Nova Scotia	59	52	60
Ontario	10,731	13,285	14,208
Quebec	8,133	9,204	10,006
Saskatchewan	42	75	81
Total	21,587	25,270	27,115

[1] Partly estimated.
[2] Includes 50 tons unclassified.

Tin

By Samuel A. Gustavson and John B. Umhau

GENERAL SUMMARY

WITH adequate supplies of tin for industry, governmental controls in effect for a decade were removed or relaxed in 1949. International allocation was discontinued and tin trading on metal exchanges was resumed.

World mine output of tin increased 8,900 long tons (6 percent) in 1949 over 1948. Most of the gain was in Malaya and Thailand, where output expanded 23 and 84 percent respectively. World smelter production increased about 11,000 tons (7 percent), mostly owing to Malaya's output, which resumed its prewar rank as the world's leading producer in 1948. The Combined Tin Committee announced November 15 that the members had recommended to their countries discontinuance of international tin allocation. The International Tin Study Group met again during 1949, continuing its investigation of means for stabilization of the tin industry through international cooperation as prescribed under the Havana Charter.

Consumption of tin in 1949 in the United States decreased 20 percent from 1948; primary tin decreased 21 percent and secondary 18 percent. The Government retained control of distribution and use of the domestic supply for the eighth consecutive year and fixed the price. However, controls were successively relaxed until, effective December 1, only certain requirements for reporting and licensing requirements for exports remained. Domestic primary smelter output, nearly all from the Government-owned smelter of Texas City, remained virtually unchanged. Secondary production was 17 percent less than in 1948. On a tonnage basis, pig-tin imports held the dominant position in the foreign tin trade in the United States in 1949 for the second time since 1941. Metal imports increased 22 percent and exceeded the tin content of concentrates by 57 percent. Receipts of concentrates, in terms of metal, were, nevertheless, 2 percent greater than in 1948. The increase was chiefly from Indonesia. Imports from Bolivia and Thailand decreased. Domestic stocks of pig tin and tin ore and concentrates at the year's end were nearly 60 percent greater than on January 1.

The domestic price for grade A tin was $1.03 from June 1, 1948, until September 28, 1949, then dropped successively until it reached 77.50 cents December 29. The annual average for 1949 was almost unchanged from 1948. The domestic market was free upon relaxation of control August 26.

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Salient statistics of tin in the United States, 1940–44 (average) and 1945–49

	1940–44 (average)	1945	1946	1947	1948	1949
Production—						
From domestic mines......long tons..	24.5	----------	----------	1.3	[1] 4.7	68.4
From domestic smelters [2]......do....	14,354	40,475	43,500	33,300	36,703	35,834
From secondary sources........do....	32,800	31,400	24,700	26,800	26,900	22,230
Imports for consumption:						
Metal..............................do....	63,539	8,493	[1] 15,559	24,899	49,196	60,224
Ore (tin content)..............do....	23,602	33,479	[1] 38,070	[1] 29,410	37,492	38,311
Exports (domestic and foreign).....do....	1,356	882	881	420	91	154
Monthly price of Straits tin at New York:						
Highest............cents per pound..	52.78	[3] 52.00	70.00	94.00	103.00	103.00
Lowest..............................do....	50.42		[3] 52.00	70.00	94.00	77.50
Average.............................do....	51.57		54.58	77.94	99.25	99.316
World mine production........long tons..	169,800	[1] 87,000	[1] 88,000	[1] 114,500	[1] 152,800	161,700

[1] Revised figure.
[2] Including tin content of ores used direct to make alloys.
[3] Ceiling price

GOVERNMENT CONTROLS

When the year 1949 opened, announcement had been made that the tin-conservation program would continue essentially unchanged, with Orders M–43 and M–81 in effect through June 30, 1949. (Tin controls had been scheduled to expire June 30.) However, chiefly because of interruption of Bolivian tin production by labor disturbances in May and June which threatened the supply of tin and tin ores, continuance of the authority over tin and tin products was recommended and extended to June 30, 1950.[1] Controls were modified to permit greater flexibility in the use of tin. Without involving allocations of tin, numerous small changes were announced March 24 which were designed to alleviate minor hardships among some groups of users. Special quota limits on beer and animal-food cans were removed, and use of electrolytic tin plate was permitted in some important classifications previously restricted to black plate and bonderized. Disposal of mill accumulations was permitted, and uses of terneplate were liberalized to include repair and replacement of roofing, smoke pipe, and flue-jacket liners for hot-water heaters. Optional use of 0.50-pound and heavier electrolytic tin plate for hot-dipped tin plate was permitted. In June further relaxations were effected. Controls were lifted on cans from 0.25 electrolytic, and 1.30- and 4.0-pound terneplate and use of 0.50 electrolytic for hand-soldered cans. On August 25, announcement was made of the revocation of Order M–81 and specification restrictions on closures (Order M–43) effective December 1, 1949. End use restrictions were eliminated, but pig-tin allocations, controls over inventories and imports were retained until discontinued by announcement November 25 of an amendment to M–43, effective December 1, which reduced controls to a reporting basis. Briefly, submission of reports was required monthly from every producer, distributor, and importer of pig tin, and any person using 1,000 pounds or more of pig tin in a calendar month, and any person having 2,000 pounds or more of pig tin in his possession or under his control on the first day of a calendar month. Also reports on imports with each customs entry were required to be filed.

[1] Public Law 153, 81st Cong., 1st sess., approved June 30, 1949.

As of December 31, 1949, tin and manufactures, including tin plate, were on the positive list requiring export license for shipment to any destination abroad except Canada.

Purchase of tin metal, ore, and concentrates and pricing were for the most part again centered in the Reconstruction Finance Corporation.[2] RFC also has authority to improve, develop, maintain, and operate by lease or otherwise the Government-owned tin smelter (Longhorn smelter) at Texas City, Tex., and to finance research in tin smelting and processing. The law requires RFC to submit semiannual reports.

The Combined Tin Committee was dissolved on November 14. An advance statement released by the committee November 15 was as follows:

> The Combined Tin Committee met November 14, 1949 and reviewed the tin position. In view of the statistical position for tin metal and in view of the fact that the London Metal Exchange is reopening November 15, 1949, the members of the Combined Tin Committee considered that continuation of the system of international allocations no longer serves its original purpose. Consequently members are recommending to their governments that the Committee be dissolved.

DOMESTIC PRODUCTION

MINE OUTPUT

Domestic mine production of tin in concentrates was 68.4 long tons in 1949 compared with 4.7 tons (revised figure) in 1948. Most of the output was derived from placer deposits in Alaska. The largest producer was the Northern Tin Company, Inc., operating on Buck Creek, Port Clarence district, Seward Peninsula, Alaska. About 39,000 cubic yards of material were processed by the company, from which about 42 long tons of concentrates containing 29.3 tons of tin (69.79 percent) were recovered and shipped. The company also moved about 47,900 cubic yards of material in stripping operations. With an output of about 38 long tons of tin-tungsten concentrates containing about 20.7 tons of tin, the United States Tin Corp. was the second-largest producer of tin from domestic mines in 1949. This company operated its placer on Lost River, Port Clarence district, Seward Peninsula region, Alaska, treating about 15,000 cubic yards of material averaging approximately 4 pounds of cassiterite (SnO_2) per cubic yard. At Climax, Colo., the Climax Molybdenum Corp. recovered a very small tonnage of tin as a byproduct of mining for molybdenum. Assays show only a trace of tin in the crude ore mined by the company. Smaller outputs of 1 ton of tin concentrates or less were produced by the Coyle & Rasmussen Mining Co., the Cleary Hill Mines Co., and Tom Dean (produced before 1949 but not previously accounted for), all in the Hot Springs district, Yukon River Basin region. Virtually all of the tin concentrates shipped in 1949 were sold to the Office of Metals Reserve.

[2] Public Law 125, 80th Cong., 61 Stat. 190, approved June 28, 1947, extended by amendment by Public Law 824, 80th Cong. (approved June 29, 1948) to June 30, 1951.

Bureau of Mines reports of investigations made in previous years of the Majuba Hill copper-tin mine,[3] Pershing County, Nev., the Potato Mountain tin placer deposits,[4] Seward Peninsula, Alaska, and the tin-bearing pegmatites in the Tinton area,[5] Lawrence County, S. Dak., were published in 1949.

Mine production of tin (content) in the United States, 1940–44 (average) and 1945–49 by States, in long tons

Year	Alaska	South Dakota	Colorado	Other States	Total	
					Long tons	Value
1940–44 (average)	19.1	1.6		3.9	24.6	$28,160
1945–46						
1947	1.3				1.3	2,200
1948	[1] [2] 4.7	(2)			[1] 4.7	[1] 10,380
1949	51.6		16.8		68.4	152,210

[1] Revised figure.
[2] A very small quantity from South Dakota is included with Alaska.

SMELTER OUTPUT

Smelters in the United States produced 35,834 long tons of tin in 1949 compared with 36,703 tons in 1948. Output was essentially that of the Government-owned smelter at Texas City. This smelter (Longhorn smelter) produced 36,053 tons (including 238 of secondary from drosses) in 1949 and 36,678 tons in 1948. The Vulcan Detinning Co. recovered a small tonnage of tin metal. This company began construction of a plant for the recovery of tin from low-grade tin concentrates in 1948 and was to have a minimum daily capacity of 25 to 50 tons of concentrates. The cost of the plant was estimated at $750,000. However, because of increased construction and other costs, this estimate was about $250,000 too low. The company annual report for 1949 contained the following statement:

> On November 30 the new plant for treating low grade tin concentrates was put into operation. Rate of production at the start was kept at a low level while the various pieces of equipment were tried out and adjusted. As is usual, various problems incident to any new development were encountered but no major difficulty developed. As we are stepping up our operations and approach the rate for which the plant was designed, we have met no insurmountable obstacle and our technical staff is confident of the practicability of the process. However, one uncertain element in the situation relates to our ability to obtain at economic prices supplies of tin concentrates, either directly from producers or from stocks purchased by the Reconstruction Finance Corporation for the government-owned smelter at Texas City.

In 1949 the Longhorn smelter treated concentrates, chiefly from Bolivia, Indonesia, Thailand, and the Belgian Congo. The smelter continued to treat low-grade middling rejects accumulated during

[3] Matson, E. J., Investigation of Majuba Hill Copper-Tin Mine, Pershing County, Nev.: Bureau of Mines Rept. of Investigations 4378, 1949, 10 pp.
[4] Heide, Harold E., and Rutledge, F. A., Investigation of Potato Mountain Tin Placer Deposits, Seward Peninsula, Northwestern Alaska: Bureau of Mines Rept. of Investigations 4418, 1949, 21 pp.
[5] Jahn, William F., and Pesonen, Paul E., Investigation of Tin-Bearing Pegmatites in the Tinton Area, Lawrence County, S. Dak.: Bureau of Mines Rept. of Investigations 4484, 1949, 25 pp.

wartime operations; by the end of the fiscal year 1949, approximately 6,000 long dry tons of rejects containing about 1,200 tons of tin had been shipped to the Capper Pass smelter, Hull, England, with the return to this country of the tin content in the form of high-grade electrolytic tin. In April RFC arranged for the processing by Vulcan Detinning Co., Sewaren, N. J., of a 500-ton lot of poorly cast pig tin previously acquired in Thailand. A small-size reverberatory furnace was installed and placed in operation at the Longhorn smelter to smelt directly all drosses and other plant byproducts carrying impurities instead of returning them to regular reverberatory furnaces for smelting. Use of this furnace will eliminate production of G-grade tin metal; instead, a small tonnage of alloy metal (Copan) will be produced. Analysis of Copan is as follows, in percent: Tin, 83.96; cadmium, trace; nickel-cobalt, 0.042; silver, 0.02; antimony, 13.05; copper, 2.635; arsenic, 0.10; lead, 0.156; bismuth, 0.017; iron, 0.015; sulfur, 0.003. Of the total tin produced at the Longhorn smelter in 1949, 64 percent was 3-Star grade; 27 percent 2-Star; 5 percent 1-Star; and 4 percent No-Star G. Most of grade G was resmelted, further refined, and converted into 2-Star and 1-Star. In December, 451 long tons of Chinese and Thai bullion were recast into 3-Star. Drosses acquired from domestic firms were also used, from which about 238 long tons of tin metal were recovered. In 1948 the percentages of the total production of the various grades were respectively 62, 31, No-1-Star, and 7. The Longhorn smelter continued to be operated on a cost-plus-fixed-fee arrangement by Tin Processing Corp., (a Delaware corporation) a subsidiary of N. V. Billiton Maatschappij. The contract with this firm has been extended to June 30, 1951. Beginning with the fiscal year ended June 1948, the fixed fee has been $200,000 per year. The RFC was authorized on June 30, 1949, by Public Law 148, Eighty-first Congress, first session, to sell tin concentrates containing not more than 25 percent tin to private interests for smelting in America into grade A tin. It provides that a minimum price at which any such concentrates of tin-bearing materials are so sold shall represent no less return to the Government, as determined or estimated by the RFC, than would result through the Government itself transporting and treating such concentrates or tin-bearing materials in any Government-owned or controlled facility and transporting and selling pig tin recovered there. Another provision is that the RFC shall contract to buy up to an equivalent amount of grade A pig tin for future delivery, not to exceed 4 months from date of delivery of such concentrates or tin-bearing material to the processor, at the RFC's selling price for such grade on the date of such contract.

The total cost of the tin-smelting program at Texas City from 1942 through June 30, 1949, was $433,613,225. This figure includes the cost of smelter facilities ($10,046,364) and the cost of concentrates, which amounted to $393,571,278, including ocean freight and delivery charges to the smelter in this country. Authorized sales from smelter production through June 30, 1949, totaled $295,800,003.

Longhorn tin-smelter production, by months, 1942–49, in long tons

Month	1942	1943	1944	1945	1946	1947	1948	1949 [1]
January	----------	2,611	2,153	3,114	3,812	3,024	3,172	3,257
February	----------	2,334	2,419	3,162	3,823	2,815	2,800	3,254
March	----------	1,491	2,513	3,310	3,881	2,877	2,602	3,104
April	525	1,055	2,611	3,407	3,891	2,816	2,906	2,851
May	1,246	1,032	2,402	3,451	3,904	3,112	3,310	3,007
June	1,663	1,498	2,439	3,502	3,856	2,712	3,651	3,006
July	1,924	1,184	2,618	3,548	3,853	2,517	3,509	2,910
August	1,655	1,347	2,553	2,912	3,672	2,237	3,509	3,005
September	2,026	2,029	2,501	3,323	3,323	2,356	2,859	2,910
October	2,014	2,059	2,651	3,558	3,125	3,026	2,300	2,964
November	2,300	2,020	2,852	3,628	3,119	2,759	2,907	2,994
December	2,343	2,037	2,907	3,676	3,209	3,041	3,153	2,791
Total	15,696	20,727	30,619	40,591	43,468	33,292	36,678	36,053

[1] Includes 238 tons of secondary from drosses.

SECONDARY TIN

The total recovery of tin from secondary metal decreased 17 percent both in quantity and in value in 1949 compared with 1948. The quantity produced in 1949 was the lowest since 1939. However, due to the high prices that prevailed both in 1948 and 1949, the value of this tin, except for 1948, was the highest on record. Most of the tin from secondary sources is recovered from tin-base scrap, which is not refined to make pure elemental metals but is refined and reprocessed to obtain a salable product, chiefly as brass and bronze, lead-base alloys, tin babbitt, and chemical compounds. In 1949 tin recovered in these products totaled 19,060 long tons, and tin recovered as metal totaled 3,170 long tons. These data indicate a 20-percent decrease in tin recovered in tin-base alloys and as chemicals and a 2-percent increase in tin recovered as metal. Detinning plants accounted for most of the recovery of tin as metal. Detinning plants recovered 3,391 long tons of tin as metal and in chemicals in 1949; tin-plate clippings and old cans were the source of 3,262 tons and other tin-bearing materials of 129 tons. The industry reported treating 387,468 long tons of tin-plate clippings in 1949, the largest on record. The average quantity of tin recovered per long ton of clean tin-plate scrap in 1949 was 18.29 pounds. Before electrolytic tin plate was introduced, recoveries averaged about 37 pounds per ton of material detinned.

To maintain comparability the quantities shown in the columns entitled "Tin recovered at detinning plants," in the accompanying table, include that recovered from tin-plate clippings and old containers only. For additional data concerning the secondary tin industry see Secondary Metals—Nonferrous chapter of this volume.

Secondary tin recovered in the United States, 1940–44 (average) and 1945–49, in long tons

Year	Tin recovered at detinning plants			Tin recovered from all sources			
	As metal	In chemicals	Total	As metal	In alloys and chemicals	Total: Long tons	Total: Value
1940–44 (average)	4,030	450	4,480	4,700	28,100	32,800	$37,897,036
1945	3,150	400	3,550	3,300	28,100	31,400	36,538,320
1946	2,480	330	2,810	2,600	22,100	24,700	30,205,663
1947	2,720	360	3,080	2,900	23,900	26,800	46,848,175
1948	2,930	340	3,270	3,100	23,800	26,900	59,796,140
1949	2,850	410	3,260	3,170	19,060	22,230	49,461,354

CONSUMPTION

APPARENT CONSUMPTION

Apparent consumption derived by adding net imports of pig tin to domestic smelter production increased 12 percent in 1949 over 1948. As changes in consumer, dealer, and Government stocks are not taken into account, apparent consumption may vary greatly from actual consumption as measured in finished products. In 1949 it was considerably in excess of actual consumption, chiefly as a result of stockpiling by the Government. The accompanying table gives the data for 1940–44 (annual average) and 1945–49. A comparable series annually for 1910–38 was published in Minerals Yearbook, 1939 (p. 680), and for 1939–48 in Minerals Yearbook, 1948 (p. 1212).

Apparent consumption of tin, 1940–44 (average) and 1945–49, in long tons

1940–44 (average)	76,537
1945	48,086
1946	58,144
1947	57,771
1948	85,808
1949	95,904

CONSUMPTION BY USES

Total domestic consumption of tin was 20 percent less in 1949 than in 1948. The use of primary tin decreased 21 percent and secondary 18 percent. Six items—tin plate and terneplate, solder, bronze, babbitt, tinning and type metal—accounted for 95 percent of the total consumed in 1948 and 1949. The use pattern was slightly different from 1948 as bronze gave place in rank to solder. In 1949, for the first time since 1941, solder resumed its prewar position in importance as the second largest user of tin. The use of significant tonnages of tin for chemicals and tin oxide were recorded.

Tin plate and terneplate used nearly two-thirds the total primary tin; but tin mills were operated at a lower rate, and 6 percent less tin was used for these products in 1949 than in 1948. Tin-plate production was 2 percent less than in 1948, chiefly because of decreases in exports and requirements for the food pack. Some production was lost as a result of cessation of operations at mills during the steel strike in the latter part of 1949. Hot-dipped tin plate production, accounting for only 45 percent of total tin plate, declined 11 percent in both production and tin consumption. Nevertheless nearly 70 percent of the total tin used to make tin plate was for hot-dipped in 1949. Electrolytic tin plate output requiring considerably less tin per unit of product than hot-dipped continued to expand and established an annual record output in 1949. By using only 3 percent more tin, electrolytic lines produced 6 percent more tin plate than in 1948. Electrolytic tin plate production alone in 1949 was virtually the same as the total domestic output of tin plate achieved 2 decades ago in 1929 (a record year, not exceeded until 1936). However, this electrolytic tin-plate production required less than a third the quantity of tin used in 1929. Hot-dipped tin plate has been used chiefly to make sanitary or packers' cans. Electrolytic tin plate, in increasing proportions, has been divided among general line cans, sanitary cans, and closures and crowns. Demand for cans of all kinds increased only 1 percent in 1949. Requirements for cans for the food pack (the chief user) decreased 2 percent, whereas that for nonfood products increased 10 percent. Greater use of beer cans accounted for most of this increase. Use of beer cans increased 28 percent and tonnagewise accounted for 11 percent of all products packed in 1949. Special quota restrictions on the amount of tin for beer cans (Order M-81—containers) were removed in March.

There were indications of the probable return to prewar practice of heavier-coated ternes, as the quantity of tin per unit specified for some of the tonnage was higher, and 60 percent more tin was required for long ternes in 1949 than in 1948, whereas tonnage output of long ternes increased only 10 percent. Total terneplate production decreased 26 percent in 1949; a drop of 55 percent in the output of short ternes offset an increase of 10 percent in the production of long ternes. Total tin used in the manufacture of terneplate decreased 7 percent.

The use of secondary tin for solder increased for the fourth consecutive year and was 18 percent more than in 1948; however, among primary items solder accounted for the largest decrease (6,888 tons). Consumption in bronze decreased the most (5,636 tons) among items in the secondary tin category. The total of primary and secondary tin used for bronze and brass decreased 33 percent, as shipments of ingot declined 37 percent in 1949. Consumption of primary tin in babbitt decreased for the fifth consecutive year and was 42 percent less in 1949 than in 1948.

Consumption of primary and secondary tin in the United States, 1940–44 (average) and 1945–49, in long tons

	1940–44	1945	1946	1947	1948	1949
Stocks on hand Jan. 1 [1]	46,407	27,391	25,789	27,100	25,743	27,070
Net receipts during year:						
Primary	68,281	54,663	56,603	59,882	62,119	47,782
Secondary	4,876	2,623	2,236	2,836	3,004	2,606
Terne	751	312	257	417	681	470
Scrap	27,050	28,498	26,057	26,598	29,840	22,193
Total receipts	100,958	86,096	85,153	89,733	95,644	73,051
Available	147,365	113,487	110,942	116,833	121,387	100,121
Stocks on hand Dec. 31 [1]	46,080	25,789	27,100	25,743	27,070	24,621
Total processed during year	101,285	87,698	83,842	91,090	94,317	75,500
Intercompany transactions in scrap	2,753	3,239	2,091	1,957	2,535	2,167
Total consumed in manufacturing	98,532	84,459	81,751	89,133	91,782	73,333
Plant losses	965	876	808	1,033	994	927
Tin content of manufactured products	97,567	83,583	80,943	88,100	90,788	72,406
Primary	67,421	55,642	54,627	59,166	59,863	47,163
Secondary	30,146	27,941	26,316	28,934	30,925	25,243

[1] Stocks shown exclude tin in transit or in other warehouses on Jan. 1, as follows: 1945, 1,941 tons; 1946, 1,600 tons; 1947, 1,000 tons; 1948, 940 tons; 1949, 328 tons; and 1950, 61 tons.

Consumption of tin in United States, 1947–49, by finished products, in long tons of contained tin

Product	1947			1948			1949		
	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	Total
Tin plate	30,980		30,980	31,503		31,503	29,617		29,617
Terneplate	192	309	501	420	252	672	278	348	626
Solder	14,126	5,954	20,080	15,038	6,087	21,125	8,150	7,206	15,356
Babbitt	3,708	2,952	6,660	3,507	3,546	7,053	2,030	2,515	4,545
Bronze and brass	4,545	16,429	20,974	3,952	17,739	21,691	2,360	12,103	14,463
Collapsible tubes	853	91	944	600	39	639	672	43	715
Tinning	2,172	335	2,507	2,298	223	2,521	1,916	158	2,074
Foil	162	182	344	179	60	239	161	38	199
Pipe and tubing	408	83	491	257	66	323	193	38	231
Type metal	130	1,457	1,587	129	1,787	1,916	81	1,693	1,774
Bar tin	881	65	946	916	132	1,048	636	159	795
Miscellaneous alloys	226	234	460	170	211	381	245	145	390
White metal	57	202	259	39	150	189	146	107	253
Chemicals (other than oxide)	726	641	1,367	855	633	1,488	64	390	454
Tin oxide							270	237	507
Miscellaneous							344	63	407
Total	59,166	28,934	88,100	59,863	30,925	90,788	47,163	25,243	72,406

STOCKS

Stocks of pig tin and tin in ore were nearly 60 percent more at the end of 1949 than at the beginning of the year. In addition, about 10,550 tons (12,400 at the beginning of year) were in process, in scrap and as secondary tin. Industry stocks of primary pig tin were off 4 percent in total; but tin platers increased their inventories 19 percent. Industry stocks increased nearly 3,000 tons in December. RFC stocks of tin metal were 24,322 tons at the beginning of the year compared with 22,452 at the year's close; stocks of concentrates contained 19,029 tons of tin at the beginning of the year and 21,117 at the close.

Stocks of virgin pig tin in the United States, Dec. 31, 1944–49, in long tons [1]

	1944	1945	1946	1947	1948	1949
At consumers' plants	17,337	14,102	14,532	13,677	14,349	13,771
At other warehouses and in transit	1,941	1,600	1,000	940	328	61
Held by jobbers	47	69	124	157	100	292
Total consumers' stocks	19,325	15,771	15,656	14,774	14,777	14,124
Afloat to United States (estimated)	1,800		1,570	6,220	25	8,500
Total stocks [1]	21,125	15,771	17,226	20,994	14,802	22,624

[1] Excludes Government purchases delivered for stockpiling or at Texas City smelter. Also excludes tin in process and secondary pig tin.

PRICES

Tin prices continued nominally subject to Government control and action during 1949. The market was substantially sustained by tin procurement for national stockpiling, as supply greatly exceeded industrial demand. The domestic market was free upon relaxation of controls August 26, 1949. From June 1, 1948, until September 28, 1949, the RFC New York selling price of grade A was $1.03 a pound. The price was lowered to 96 cents on September 28 and to 95 cents on October 24, at which it was maintained until reduced to 85 cents on November 21. Between then and the end of the year the price was changed downward by RFC eight times until December 29, when the price was 77.50 cents. For the most part the open market price did not conform with RFC's price, which was brought in line with other offerings for grade A. RFC's prices of lower grade also did not always conform with outside market quotations. In December, grade B was

Tin prices, 1925–29 (average), and 1945–49

	1925–29 (average)	1945	1946	1947	1948	1949
Average prices:						
New York: [1]						
Straits tin ... cents per pound	56.64	[2] 52.00	[3] 54.58	77.94	99.25	99.316
99.75-percent tin (English refined) cents per pound	(4)	[5] 51.625	[5] 54.208	77.512	98.692	(4)
99-percent tin ... do	55.50	[6] 51.125	[6] 53.708	76.896	97.562	(4)
London: [7]						
Standard tin ... £ per long ton	254.6	[8] 300.0	[9] 321.2	426.3	548.1	600.8
Do ... cents [10] per pound	55.17	[11] 54.04	57.83	77.66	98.64	98.92
Premium allowed over standard:						
Straits ... £ per long ton	5.1	(4)	(4)	(4)	(4)	(4)
Banka ... do	6.9	(4)	(4)	(4)	(4)	(4)
English ... do	-.7	(4)	(4)	(4)	(4)	(4)
Price indexes (1925–29 average=100):						
Straits tin (New York)	100	92	96	138	175	175
Copper (New York)	100	80	93	143	150	131
Lead (New York)	100	87	109	196	241	206
Nonferrous metals [12]	100	87	100	142	159	146
All commodities [12]	100	108	121	155	168	158

[1] American Metal Market.
[2] Maximum for grade A, 99.8 percent or higher (includes Straits).
[3] Maximum price for grade A, 52 cents until Nov. 10, 1946; 70 cents thereafter.
[4] Data not available.
[5] Maximum for grade B, 99.75–99.79 percent, and grade C, Cornish refined.
[6] Maximum for grade D, 99.0–99.74 percent.
[7] Metal Bulletin, London.
[8] British Government maximum price.
[9] British Government maximum. To Sept. 26, £300, thereafter £380 10s.
[10] Conversion of British quotations into American money based upon average rates of exchange recorded by Federal Reserve Board.
[11] Official rate; free rate, 53.98.
[12] Based upon price indexes of U. S. Department of Labor.

quoted by RFC at 82.8 cents, while English refined was being sold at about 79 cents; with RFC 99 percent at about 81⅛ cents, Chinese 99 percent was available at 76.5 cents. However, RFC began offering grade A at or below outside market prices on December 2 when it reduced its price to 81 cents. Other changes were effected to correspond somewhat with offerings by the British Ministry of Supply.

In the United Kingdom there was an artificial price of £569 a ton until sterling devaluation September 18 when partial readjustment began. Readjustment was accelerated when the London Metal Exchange reopened November 15. The British Ministry of Supply withdrew Straits tin from the American market on August 30 to prevent dollar losses. This action was reversed September 9, and American sales for future shipments from Malaya were permitted. However, the British Ministry of Supply suspended sales from midnight September 17. Following devaluation of sterling on September 18, the British Ministry of Supply raised its selling price to £750 per ton September 26 and reduced the selling price in New York from $1.03 to 95 cents a pound. British Ministry of Supply Control of Tin order 6 (revocation), 1949, freed tin from control November 15, 1949, and the London Metal Exchange reopened for dealings in tin. At the same time the Singapore market was allowed to resume operations. Resumption of trading on the London Metal Exchange after almost 9 years produced the greatest premium for prompt Standard tin ever recorded. Prompt metal was sparsely offered, resulting in a big backwardation. There was a spread of as much as £91 in the afternoon session November 18. Three months futures went down to £565 before improvement set in, but on December 23 it stood at £582 10s. while the spot quotation was £606. On the last day of the London metal market, at the year's close, cash tin was recorded changing hands at £600 to £601 10s. Unavailability of free tin made market conditions artificial as the year closed. The chairman of the exchange was appointed Government broker, with all British Ministry of Supply commissions pooled and after deduction of expenses, divided among certain members. The freedom of the market was complete but was reserved for authorized firms whose operations were subject to post facto control.

Although the Singapore market opened November 16, it was unable to function because, probably, for the first time on record, there were no outright buyers and no price could be established without their bids. On November 18, Straits on the Singapore market underwent a very large decline of £60 per ton to £578 4s. 5d. The market opened at the equivalent of £638 4s. 10d. on November 17 (a drop of about £100 from the British asking price of Straits f. o. b. Singapore before November 15). At the year's close the price of tin at Singapore ex smelter was quoted at £562⅝. From November 1946 to November 14, 1949, the British Ministry of Supply was the sole purchaser of exported metallic tin ex Penang and Singapore. Tin prices, ex works, averaged the equivalent of 94.78 cents per pound in 1949 against 95.73 cents in 1948.

From September 19 to November 15 as far as sales of Malayan tin matched intake, Malayan smelters and producers got the benefit of active selling price or current selling price of £739 per ton, ex

smelter Penang and Singapore, smelters were to get £728, the difference representing warehousing, interest charges, etc. To the extent, if any, that intake exceeded sales so that the Ministry had to increase its stocks of Malayan tin, smelters were to be paid at the price ruling before September 19—£553½. It was the intention of the Ministry to see that any release in its stocks would be orderly with due regard to need for reasonable price stability for tin pending termination of final price to smelters in above manner. An interim payment of 80 percent of the smelters' share of the current selling price at the time—£582½ (72.81 cents per pound) was to be made. The balance was payable to the Government of the Federation of Malaya for distribution to the industry after deduction of taxation. A similar arrangement was in effect with Nigeria during the period, with 80 percent interim payment based on current United Kingdom selling price of £750 sterling or £567 per ton of tin and ore f.a.s. Nigerian port.

FOREIGN TRADE [6]

Tin, one of the principal imports of the United States, ranked eighth in value among all the commodities in 1949. Before the war (1935–39 average) it was in sixth place. Imports of pig tin and ore and exports of tin plate are the principal tin items in foreign trade of the United States. Of less importance has been foreign trade in imports of tin plate and terneplate and exports and imports of scrap, circles, strips, waste-waste, miscellaneous tin and manufactures and compounds. In 1949 imports of pig tin for consumption totaled 60,224 long tons, the highest since 1941, and imports of tin in concentrates were 38,311 tons, the highest in history. Total exports of tin plate, taggers tin, and terneplate (including long ternes) were 498,371 tons, a 9-percent decrease from 1948. Further data on imports and exports are shown in the accompanying tables. Tin contained in babbitt, solder, type metal, and bronze imported and exported is accounted for in the Lead and Copper chapters of this volume. In 1948, on a tonnage basis, pig-tin imports resumed (for the first time since 1941) the dominant position in the foreign trade of the United States. This position was retained and strengthened in 1949, with a 22-percent increase in imports of metal over those of 1948.

Malaya was the principal source of metal in 1949, furnishing 57 percent of the total. Other important sources of metal imported in 1949 include Belgium, the Netherlands, Belgian Congo, China, and the United Kingdom. Imports from the Netherlands and the United Kingdom increased substantially over 1948.

Imports of tin and concentrates in the United States increased 2 percent in 1949, as compared with 1948. Bolivia, the chief source, supplied concentrates containing 19,265 long tons of tin and accounted for 50 percent of the total. The second-largest source of tin imported as concentrates was Indonesia, supplying 15,223 tons. Other smaller sources included Thailand, Belgian Congo, China, Mexico, Portugal, Malaya, and Burma. Bolivia has been the source of 70 percent of the tin in concentrates imported from 1941 through 1949, inclusive.

[6] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Since 1941 the United States has been the world's principal source of tin plate. In 1949 exports of tin plate, taggers tin, and terneplate, including long ternes, decreased 9 percent from 1948 and 10 percent from the high level attained in 1947. In 1949 ground was lost in the export markets, chiefly, of Argentina, Belgium-Luxembourg, Brazil, Canada, Cuba, France, and Portugal. There were significant increases in exports to Denmark, Italy, and the Netherlands. Gains recorded in these and other European countries were mostly accountable to Economic Cooperation Administration (ECA).

Exports of hot-dipped tin plate totaled 384,022 long tons valued at $76,163,093 in 1949. Principal countries of destination were the Netherlands (46,907 tons), Australia (37,461 tons), Brazil (30,948 tons), and Italy (25,347 tons). Exports of electrolytic tin plate totaled 98,015 tons valued at $17,299,264. This material was shipped to 20 countries, the leading ones being the Union of South Africa, Canada, the Netherlands, Brazil, Turkey, the Philippines, and Australia. Late in 1949 a comparatively large tonnage of tin plate was imported into the United States from Canada, presumably to supplement a shortage caused by the steel strike (October–November).

According to the American Iron and Steel Institute, producers in 1949 shipped for export 519,618 short tons (601,697 in 1948) of tin plate, of which 402,821 tons (508,474 in 1948) were hot-dipped and 116,797 (93,223 in 1948) electrolytic.

Tin ore, concentrates, metal, alloys, scrap, and tin-plate scrap are duty-free. However, the duty-free status of the above articles was made subject to the provision in paragraph 1785 of the Tariff Act of 1930 (and the corresponding provision of the Tariff Act of 1922) that there shall be imposed and paid upon cassiterite, or black oxide tin, a duty of 4 cents per pound, and upon bar, block, pig tin, and grain or granulated a duty of 6 cents per pound when the mines of the United States are producing 1,500 tons of cassiterite and bar, block, and pig tin per year. Subject to this condition, the duty-free status of the articles specified in paragraphs 1785 and 1786 was bound in the Geneva agreement; the duty-free status of the articles in paragraph 1786 was previously bound in the trade agreement with the United Kingdom, effective January 1939.

Foreign trade of the United States in tin concentrates and tin, 1945–49

[U. S. Department of Commerce]

Year	Imports				Exports			
	Concentrates (tin content)		Bars, blocks, pigs, grain, or granulated		Ingots, pigs, bars, etc.			
					Domestic		Foreign	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
1945	33,479	$44,795,893	8,493	$9,213,425	708	$890,661	174	$223,623
1946	[1] 38,070	[1] 50,623,185	[1] 15,559	[1] 18,554,896	859	1,153,936	22	31,939
1947	[1] 29,410	[1] 43,220,686	24,899	42,684,651	415	650,162	5	9,887
1948	37,492	72,170,372	49,196	103,322,952	78	163,428	13	27,699
1949	38,311	78,175,836	60,224	133,696,493	76	176,795	78	145,370

[1] Revised figure.

Tin concentrates (tin content) imported for consumption in the United States, 1942–49, by countries

[U. S. Department of Commerce]

Country	1942		1943		1944		1945		1946		1947		1948		1949	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Algeria			5	$7,125												
Argentina					60	$77,498										
Australia											2	$1,036				
Belgian Congo			4,094	4,511,588	7,549	9,368,309	7,401	$9,214,245	7,214	$8,081,430	379	631,060			695	$1,526,556
Bolivia	20,750	$23,157,000	17,351	20,005,703	27,701	32,160,861	25,936	35,376,704	[1] 28,520	[1] 38,901,007	20,984	30,654,538	[1] 20,367	[1] $37,855,610	19,265	37,363,057
Brazil									7	9,821	1	2,493	2	3,365		
British East Africa									([2])	259						
Burma															11	11,329
Chile			([2])	198					([2])	6					([2])	207
China													16	15,737	348	622,548
French Cameroon	161	154,934	72	83,490	177	254,844	46	68,136	37	55,367						
French Equatorial Africa			211	211,810			83	123,346	21	31,500						
Indonesia	7,977	9,109,734							2,206	2,532,488	[1] 5,208	[1] 7,315,323	13,195	26,652,641	15,223	32,851,078
Malaya															22	48,000
Mexico	45	32,616	121	134,337	61	80,543	13	13,462			5	5,982	36	12,331	116	150,583
Portugal									38	56,767					61	122,441
Spain													11	11,436		
Thailand											2,826	4,601,681	3,865	7,619,185	2,570	5,480,037
United Kingdom									27	54,540	5	8,573	([2])	67		
Total	28,933	32,454,284	21,857	24,954,251	35,548	41,942,055	33,479	44,795,893	[1] 38,070	[1] 50,623,185	[1] 29,410	[1] 43,220,686	37,492	72,170,372	38,311	78,175,836

[1] Revised figure.
[2] Less than 1 ton.

Export priority quotas were discontinued, and the only requirement for export was obtaining a license from the Office of International Trade, United States Department of Commerce. Shipments to Canada were exempt from export control.

Tin[1] imported for consumption in the United States, 1946–49, by countries

[U. S. Department of Commerce]

Country	1946		1947		1948		1949	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Belgian Congo	627	$730,238	[2] 1,050	[2] $1,840,553	2,046	$4,463,295	3,735	$8,293,083
Belgium-Luxembourg			[2] 3,500	[2] 6,263,723	6,874	15,355,653	7,579	17,179,194
Bolivia					49	95,279	246	596,367
Burma							6	9,805
China	984	1,210,129	2,639	4,323,184	1,615	3,172,982	3,641	6,640,135
French Indochina							50	78,919
Indonesia	[2] 7,495	[2] 8,837,722	39	66,850			58	121,194
Japan							4	6,250
Malaya	[2] 2,061	[2] 2,395,369	13,432	23,207,914	34,176	71,389,379	34,374	77,317,247
Mexico	24	27,215						
Netherlands					843	1,899,249	7,566	17,006,366
Portugal	9	10,517	(3)	66	95	195,223		
Portuguese Asia							48	81,730
Thailand	87	100,906	4,031	6,648,718	2,978	5,591,093		
United Kingdom	4,272	5,242,800	208	333,643	520	1,160,799	2,917	6,366,203
Total	[2] 15,559	[2] 18,554,896	24,899	42,684,651	49,196	103,322,952	60,224	133,696,493

[1] Bars, blocks, pigs, grain, or granulated.
[2] Revised figure.
[3] Less than 1 ton

Foreign trade in tin plate, taggers tin, and terneplate in various forms, 1945–49, in long tons

[U. S. Department of Commerce]

Year	Tin plate, taggers tin, and terneplate		Tin-plate circles, strips, cobbles, etc. (exports)	Waste-waste tin plate (exports)	Terneplate clippings and scrap (exports)	Tin-plate scrap	
	Imports	Exports				Imports	Exports
1945	147	471,080	1,684	12,215	378	18,072	433
1946	298	355,794	4,030	6,690	590	24,530	141
1947	585	553,748	5,340	21,209	9	30,797	54
1948	184	548,021	3,247	28,121	278	41,084	(1)
1949	12,218	498,371	3,018	41,865	227	41,028	

[1] Revised to none.

Tin plate, taggers tin, and terneplate (including long ternes) exported from the United States, 1948–49, by principal countries of destination

[U. S. Department of Commerce]

Destination	1948		1949	
	Long tons	Value	Long tons	Value
Algeria	3,993	$715,272	4,102	$815,134
Argentina	37,055	6,821,619	16,607	3,277,074
Australia	43,835	7,675,274	42,637	8,385,745
Belgium-Luxembourg	19,915	3,643,193	10,918	2,143,343
Brazil	62,490	10,991,796	40,003	7,794,469
British East Africa	962	148,096	3,276	550,107
Canada	49,603	7,191,526	29,569	4,762,289
Chile	9,505	1,773,240	7,897	1,528,610
China	4,763	871,993	1,895	372,428
Colombia	4,413	777,828	3,859	715,865
Cuba	20,237	3,722,574	11,092	2,211,706
Denmark	7,091	1,274,786	15,161	2,931,342
Egypt	3,062	586,382	4,888	928,968
France	14,287	2,737,300	7,249	1,399,858
Greece	4,768	827,508	5,955	1,062,214
Hong Kong	2,669	377,904	4,740	696,995
India	12,749	2,297,053	15,066	2,708,593
Indochina, French	1,792	292,715	885	150,915
Indonesia	6,422	1,137,526	5,198	1,032,466
Ireland	1,386	285,774	1,971	380,402
Israel-Jordan	1,382	259,557	3,793	750,158
Italy	10,707	1,820,420	26,518	5,345,010
Japan	3,108	695,300	3,358	753,752
Lebanon	1,884	326,695	1,120	206,016
Madagascar	2,361	451,039	1,195	242,456
Malaya	3,063	467,632	3,977	690,293
Mexico	13,616	2,332,339	15,173	3,106,323
Morocco, French	8,031	1,585,541	10,629	2,162,855
Netherlands	38,797	6,984,822	56,136	11,207,608
New Zealand	7,783	1,369,138	4,633	919,159
Norway	22,519	3,799,901	21,471	4,060,002
Pakistan	1,653	259,043	5,361	980,343
Peru	2,996	576,308	2,551	540,669
Philippines, Republic of	9,911	1,687,467	10,284	1,803,789
Portugal	19,365	4,365,079	10,042	1,995,270
Spain	730	149,727	3,165	652,046
Sweden	14,211	2,548,916	7,280	1,426,023
Switzerland	13,367	2,387,653	9,315	1,760,879
Thailand	253	51,379	4,093	568,656
Tunisia	945	185,097	1,703	340,322
Turkey	10,077	1,636,381	10,662	1,903,676
Union of South Africa	32,780	5,598,747	30,659	5,940,554
Uruguay	8,321	1,576,577	5,324	1,054,382
Venezuela	3,632	680,570	2,733	514,569
Other countries	5,532	1,158,117	14,228	2,889,635
Total	548,021	97,102,604	498,371	95,662,968

Foreign trade in miscellaneous tin, tin manufactures, and tin compounds, 1945–49

[U. S. Department of Commerce]

Year	Miscellaneous tin and manufactures				Tin compounds	
	Imports			Exports—tin scrap and other tin bearing material, except tinplate scrap (value)	Imports (pounds)	Exports (pounds)
	Tin foil, tin powder, flitters, metallics, and tin manufactures, n. s. p. f. (value)	Dross, skimmings, scrap, residues, and tin alloys, n. s. p. f.				
		Pounds	Value			
1945	$1,403	127,680	$29	$453,816	25	35,107
1946	5,298	1,100	596	482,733	308	(1)
1947	2,023	293,982	27,334	[2] 829,386	30,760	(1)
1948	18,327	1,679,331	659,450	[2] 1,684,402	10,917	(1)
1949	25,836	1,152,674	420,244	2,245,217	980	41,004

[1] Not separately
[2] Revised figure.

TECHNOLOGY

The Bureau of Mines, in cooperation with the United States Department of State and the Bolivian Government, continued research on recovery of tin from low-grade ores by sulfide volatilization. A description of a sulfide volatilization process for the recovery of tin from ores and used in Germany was published.[7]

A brief résumé of the tin-smelting process at the Government's Texas City plant and at the Vulcan Detinning Co. plant at Sewaren, N. J., follows:

At the Texas City plant ores are mixed with salt and ground coke and roasted in a rotary kiln to reduce the iron to the ferrous state and chloridize the lead and silver. The roasted ore is leached in spherical tanks with acidproof lining in a solution of hydrochloric acid at 100° F. to remove iron and other undesirable impurities before smelting. When leaching is complete, a filter screen is placed over the manhole, the tank is inverted, and air pressure is applied until the filter cake is blown fairly dry. The leached residue is smelted in separate lots in eight reverberatory furnaces. About 85 percent of the tin is recovered as crude bullion, and the remainder is retained in a low-silica slag. The slag from the primary smelting furnaces is resmelted in a larger furnace to recover the tin as an iron-tin alloy known as hard-head. The hard-head is granulated and returned to the primary furnaces for resmelting.

The crude bullion is dressed and then held at a temperature slightly above the melting point to permit formation of crystals of the metallic compound $FeSn_2$. These crystals are removed by filtering the hot metal through a porous tile metal filter, giving a bullion containing only about 0.006 percent impurities. Arsenic, antimony, and bismuth are removed as a dross by successive additions of metallic aluminum, molten sulfur, and sodium hydroxide. The refined bullion is stored in a reverberatory furnace, from which it is removed and cast into pigs.

In the original plant, as it was operated during the war, the leach liquors were drained into a storage pond. Since then an acid recovery plant has been constructed for draining these waste liquors to recover hydrochloric acid and small quantities of lead, silver, copper, and tin that are dissolved during the acid leach.

At the Vulcan Detinning Co. plant a process developed by the company for recovering tin from low-grade Bolivian ore is used. The process is described in United States Patent 2,416,709, issued March 4, 1947, and consists of the following steps:

1. Reduction of finely ground tin ore to the metallic state in a rotary kiln.
2. Leaching of the roasted ore in a hot solution of sodium hydroxide ($NaOH$) and sodium nitrate ($NaNO_3$) to extract the tin as sodium stannate.
3. Precipitation of tin oxide by carbonation of the sodium stannate solution to produce pure tin oxide which may be reduced to give pure metallic tin.

An alternate procedure to step 3 is to evaporate and crystallize sodium stannate, which may then be used to make up electrolyte for producing electrolytic refined tin such as is produced by Vulcan in its detinning plant at Neville Island near Pittsburgh.

A process for the recovery of tin from tin slags was described.[8] The Ashcroft-Elmore tin process, which consists essentially in distilling a mixture of finely ground tin concentrate with a reducing agent (charcoal, low-temperature coke) and ferrous chloride, was described.[9]

[7] Jensen, C. W., Waelz Plants for Low-Grade Tin: Mining Mag., London, vol. 81, No. 5, November 1949, p. 265.
[8] Jensen, C. W., Fuming Tin Slags: Mining Mag., London, vol. 81, No. 6, December 1949, p. 337.
[9] Malan, H. L., the Ashcroft-Elmore Tin Process: Mining Mag., London, vol. 81, No. 3, September 1949, p. 137.

United States patents issued during 1949 relative to tin include the following:

Jordan, J. F., Process for the Extraction of Tin from Iron Alloys: U. S. Patent 2,474,979, July 5, 1949.
Chace, P. G., Corrosion-resisting Composite Metal: U. S. Patent 2,482,897, Sept. 27, 1949.
Waterfall, F. D., Selective Carburization of Metals: U. S. Patent 2,485,176, Oct. 18, 1949.
Stumbock, M. J., Electrical Contact Element Containing Tin Oxide: U. S. Patent 2,486,341, Oct. 25, 1949.
Rudolph, G. A., Process of Making Stannic Acid From Tin Bearing Material: U. S. Patent 2,486,800, Nov. 1, 1949.
Clifton, F. L., Electrodeposition of Tin or Lead-Tin Alloys: U. S. Patent 2,489,523, Nov. 29, 1949.

A meter, developed at the research laboratory of the Carnegie-Illinois Steel Corp., which continuously indicates and records the tin-coating thickness on steel strip during the plating operation, is now in use on the Ferrostan electrolytic tinning lines of the United States Steel Co. and subsidiaries. The meter is reported to indicate tin-coating weights as accurately as chemical methods.

Tin Research Institute, Inc., 492 West Sixth Avenue, Columbus, Ohio, offers free service for technical inquiries and general information on tin. A sponsorship with Battelle Memorial Institute provides facilities for technical investigations. The Tin Research Institute, Inc., maintains a technical library on tin and has a number of publications available for free distribution. Among those made available in 1949 were: Tin and Its Uses, March 1949, No. 20; Tin and Its Uses, October 1949, No. 21; Fusible Alloys Containing Tin; Equilibrium Data for Tin Alloys; and Report on the Work of the Tin Research Institute, 1947–48.

WORLD REVIEW

INTERNATIONAL TIN STUDY GROUP

Representatives of eight major tin producing and consuming countries met in London in October 1946 and agreed that a study group should be established. The International Tin Study Group was organized at a meeting in Brussels in April 1947. A brief report on the meetings held by the study group through 1949 has been published as follows: [10]

At the first meeting of the International Tin Study Group held in Brussels in April 1947, terms of reference for the Group were agreed. The principal features of these terms of reference are (1) that membership shall be open to all countries principally interested in the production, consumption or trade in tin; (2) that the Group shall have the functions of considering possible solutions to any problems or difficulties which are unlikely to be resolved by the ordinary development or world trade in tin; and (3) that the Group should establish a permanent secretariat.

The second Group Meeting was held in Washington in April 1948. The Group reviewed the world tin position and agreed to recommend to member-governments the setting up of a Working Party to examine the appropriateness

[10] International Tin Study Group, Statistical Bulletin: Vol. 2, No. 6, June 1949, and vol. 3, No. 1, January 1950, inside cover page.

and practicability of framing an intergovernmental agreement on tin conforming to the general spirit and principles of the Charter of the International Trade Organization. The meeting of this Working Party was held in The Hague in June 1948.

The Group held its third meeting in The Hague on October 25th/29th, 1948. The Group had before it the report of the Working Party. The purport of this report was that it would be appropriate and practicable to conclude an international tin agreement on the lines set out in the report. The Group modified these proposals in certain respects and forwarded to the member-governments a recommendation that, after certain preparatory steps, the member-governments should be asked to inform the Secretary whether they would be disposed to enter into an agreement on the broad lines proposed, and were willing to attend a conference to put the agreement into final form and to conclude it.

The Fourth Group Meeting was held in London on June 14th–22nd, 1949. The Group received the Report of the Drafting Committee set up at their last meeting and noted that the summoning of an International Commodity Conference on tin in the spring of 1949 had not been considered timely by all member governments. The Group set up a Working Party to prepare a statement on the position and prospects of the tin industry and also to prepare the draft on an Intergovernmental Commodity Control Agreement.

The Working Party met in The Hague from October 26th to November 2nd, 1949. It prepared the statement and the draft tin control agreement for the consideration of the member-governments. The draft agreement is designed, in the spirit of the Havana Charter, to establish equilibrium between supply and demand on conditions equally satisfactory to producers and consumers. It will be considered at the Fifth Group Meeting in the spring of 1950.

A Management Committee supervises the work of the Secretariat. The following are represented on that Committee: Belgium, Bolivia, British Colonies. France, Netherlands, United Kingdom and United States of America.

The Secretariat has been established at 7, Carel van Bylandtlaan, The Hague, Holland, to which all communications should be addressed.

The present membership of the Group is:

Australia	France
Belgium	India
Bolivia	Italy
British Colonies and Dependent Territories	Netherlands
Canada	Thailand
China	United Kingdom
Czechoslovakia	United States of America

WORLD MINE PRODUCTION

World mine production of tin, exclusive of U. S. S. R., increased 6 percent in 1949. Of the total output, Asia supplied 60 percent, South America 22 percent, Africa 15 percent, and other sources 3 percent. Most of the increase was provided by Malaya. Output in 1949 was 8,900 long tons greater than in 1948. Production in 1949 was 99 percent of the 1925-29 average, 94 percent of the 1935–39 average, and about two-thirds of the 1941 peak. U. S. S. R. mine production has been estimated [11] as follows: 1939–43 average, 2,500 to 3,000 long tons; 1944, 4,000 tons; 1945, 4,500 tons; 1946, 5,000 tons; 1947, 6,500 to 7,500 tons; 1948, 7,500 to 9,000 tons; 1949, 9,000 to 10,000 tons. The target for 1950 was reported to be 12,000 tons.

[11] Metal Bulletin, London. No. 3455, Jan. 3, 1950, and No. 3490, May 9, 1950, and other sources

World mine production of tin (content of ore), by countries, 1939–43 (average) and 1944–49, in long tons [1]

[Compiled by Berenice B. Mitchell]

Country	1939–43 (average)	1944	1945	1946	1947	1948	1949
North America:							
Canada	186	231	379	390	319	309	276
Mexico	327	317	174	262	174	182	358
United States	30	5			1	5	68
Total North America	543	553	553	652	494	496	702
South America:							
Argentina	1,225	986	974	[2] 600	522	273	[2] 300
Bolivia (exports)	37,433	38,720	42,487	37,619	33,266	37,336	34,115
Brazil	34	154	122	269	295	570	325
Peru	64	73	54	31	51	64	44
Total South America	38,756	39,933	43,637	38,519	34,134	38,243	34,784
Europe:							
France		3	10	10	43	84	73
Germany [3]	482	[2] 980			[2] 100	[2] 100	[2] 120
Italy	230	44	34	107	50		
Portugal [4]	1,545	164	576	352	361	750	820
Spain	131	441	1,141	921	303	261	[2] 300
United Kingdom	1,497	1,289	1,152	793	898	1,281	1,217
Total Europe [5]	3,885	2,921	2,913	2,183	1,755	2,476	2,530
Africa:							
Belgian Congo	13,727	17,326	17,077	14,091	14,897	13,700	13,900
French Cameroon	230	161	116	111	119	102	73
French Morocco	18	9	8	9			
Mozambique	7	8	3	2	1		
Nigeria	11,876	12,512	11,224	10,333	9,133	9,237	8,824
Northern Rhodesia	6	6	18	6	1		7
Southern Rhodesia	294	123	125	100	122	105	70
South-West Africa	135	126	184	177	146	111	129
Swaziland	114	77	53	37	23	20	32
Tanganyika (exports)	216	116	138	128	92	97	110
Uganda (exports)	314	281	215	206	154	190	131
Union of South Africa	499	505	501	487	483	457	471
Total Africa	27,436	31,250	29,662	25,687	25,171	24,019	23,747
Asia:							
Burma	3,618	[2] 500	[2] 400	342	1,792	1,147	1,781
China (estimate)	10,600	3,000	1,500	2,500	4,300	4,800	4,200
French Indochina	1,183	358	42			30	[2] 60
Indonesia	29,931	7,005	1,050	6,419	15,915	30,562	28,965
Japan	1,682	374	56	57	110	118	189
Malaya	50,131	9,309	3,152	8,432	27,026	44,815	54,910
Thailand	12,451	3,296	1,775	1,056	1,401	4,240	7,815
Total Asia	109,596	23,845	7,975	18,806	50,544	85,712	97,920
Oceania: Australia	3,126	2,547	2,282	2,127	2,445	1,874	1,973
World total [5]	183,342	101,000	87,000	88,000	114,500	152,800	161,700

[1] Based partly on the Statistical Bulletin of the International Tin Study Group, The Hague.
[2] Estimate by authors of chapter.
[3] Data include Sudetenland, 1939–45.
[4] Excluding mixed concentrates.
[5] Excluding production of U. S. S. R., estimates for which are given in the accompanying text.

WORLD SMELTER PRODUCTION

Smelter production of tin in the world, exclusive of U. S. S. R., increased only 7 percent in 1949 over 1948. The Malayan tin-smelting plants at Penang and Singapore recorded a 26-percent increase in output, supplied 37 percent of the total, and were (as in 1948) the world's most important sources of pig tin. Next in rank as important tin-smelting sources are the United States, United Kingdom, Nether-

lands, and Belgium. Smelters in these countries supplied 92 percent of the world's tin in 1949.

About 60 percent of the world smelter output in 1949 was for the United States (in 1948, 55 percent). International allocations of tin metal by the Combined Tin Committee were continued through November 15, after which time the allocations were discontinued and tin purchases on the open market resumed.

World smelter production of tin, by countries, 1939–43 (average) and 1944–49, in long tons

[Compiled by Berenice B. Mitchell]

Country	1939–43 (average)	1944	1945	1946	1947	1948	1949
Argentina	798	662	469	837	433	254	[1] 300
Australia	3,217	2,442	2,359	2,225	2,371	1,885	1,955
Belgian Congo	9,478	9,905	8,518	3,414	3,084	3,875	3,247
Belgium	620			1,405	12,059	10,469	8,996
Bolivia (exports)			1		26	81	402
Brazil	[2] 20	211	169	178	220	[1] 240	325
Canada	186	231	379	390	319	309	276
China	8,557	2,160	3,268	1,929	3,907	[1] 4,800	[1] 4,200
French Indochina	159	192	14			32	[1] 60
Germany (Federal Republic)	1,050	1,020				[3] 26	[1,3] 120
Indonesia	15,795	6,069	844			136	126
Italy	156	2	6	75	46		
Japan	2,447	759	121	162	53	145	479
Malaya	74,247	10,983	3,038	11,533	29,318	49,707	62,737
Mexico	214	286	166	263	172	181	358
Netherlands	3,513			945	8,981	16,402	19,487
Norway	132	27	80	308			(4)
Portugal	1,546	610	182	114	373	282	[1] 240
Southern Rhodesia	[2] 32	134	117	80	121	127	[1] 120
Spain	111	515	1,111	1,440	704	483	718
Thailand	470	3,535	1,652	389	141		
Union of South Africa	315	1,150	1,033	858	601	554	595
United Kingdom	38,770	28,589	27,549	29,121	28,083	[5] 31,002	[5] 28,384
United States [6]	8,177	30,884	40,475	43,500	33,300	36,703	35,834
Total (estimate)	170,000	100,400	91,600	99,200	124,300	157,700	169,000

[1] Estimated by authors of the chapter and in a few instances from Statistical Bulletin of the International Tin Study Group.
[2] No production 1939–42; average based on 1943 data.
[3] American and British zones only.
[4] Data not available; estimate by authors of chapter included in total.
[5] Beginning January 1948, includes production from imported scrap and residues refined on toll.
[6] Including tin content of ores used direct to make alloys.

REVIEW BY COUNTRIES

Australia.—Production of tin in ores and concentrates was chiefly from Queensland, Tasmania, and New South Wales. Victoria, Western Australia, and the Northern Territory produced small quantities. Output in 1949 in Queensland increased 258 tons over 1948, offsetting a decrease in production from Tasmania of 146 tons. The largest individual producer was Tableland Tin Dredging, N. L., of Mount Garnet, Queensland, with a reported output of 689 tons of concentrates. (The average content of concentrates produced in Queensland in 1949 was 70 percent.) Prospecting and development were continued in the Mount Garnet district during the year. Plans for constructing a tin-plate mill at Port Kembla, New South Wales, were completed. Both electrolytic and hot-dipped tin plate are to be made. Estimated capacity will be about 120,000 tons of tin plate annually, requiring about 2,000 tons of tin.

Belgian Congo.—The closing of tin-smelting operations at Lubudi by Sermikat (Societe d'Exploitation et de Recherches Miniéres au Katanga) as a result of power shortage caused by decreased rainfall resulted in a 16-percent decrease in tin-ingot output in 1949. Therefore, the entire output was by the Geomines (Compagnie Geologique et Miniére des Ingenieurs et Industriels Belges S. A.) smelter at Manono, where output was 3,247 long tons, a slight decrease from the 3,268 tons produced in 1948. Total output of ore and concentrates in the Congo and Ruanda-Urundi was 18,061 long tons containing 13,184 tons of tin in 1949, a slight increase over that of 1948. Of the 1949 output, Ruanda-Urundi supplied 12.5 percent compared with 10.5 percent in 1948. In addition, tin is recovered from tin-tungsten and tantalum-columbium-tin concentrates and is included in the production shown for the Belgian Congo in the world table in this chapter.

Symetain's (Syndicat Miniére d'Etain) output of 4,671 metric tons of cassiterite containing 3,516 tons of tin brought total production (metal basis) from the beginning of operations in 1932 to over the 50,000-metric-ton mark. Work on the hydroelectric installations on the Lutshurukuru River to increase available power and permit greater mechanization, continued throughout the year and is expected to be finished by the end of 1951.

Geomines continued construction of a new plant for processing unweathered tin-bearing pegmatites, and the first unit with a capacity of 2,250 metric tons annually is scheduled for completion in early 1950. A second unit is expected to be in operation a year later, with others to follow until a total capacity of 10,000 metric tons is obtained. Drilling has indicated a reserve sufficient for 50 years' operation at the increased rate.

A low-pressure steam turbine has been ordered by Sermikat for an installation utilizing the water of a hot spring, furnishing 40 liters per second at 93° temperature. This installation will supply 250 kw.-hr. and is scheduled for operation in the first quarter of 1952.

Exports of tin metal were 4,588 metric tons and of tin concentrates 13,282 metric tons. Of the metal exports, the United States was shipped 3,833 metric tons, an increase of 64 percent over those of 1948. Tin concentrates shipped to the United States—the first since June 1947—totaled 1,033 metric tons.

According to regulations of July 1948, taxation on tin includes the following: (1) An 11-percent ad valorem tax based on a value fixed by the Governor General on tin metal and tin concentrates; (2) direct taxes on buildings, employees, and each mining concession and exclusive prospecting right; (3) income tax and a supplementary tax which replaces the additional export duty.

Bolivia.—Bolivia exported 9 percent less tin in concentrates in 1949 than in 1948. Tin contained in exports of concentrates in 1949 totaled 34,115 long tons. Exports of metal from the Oruro smelter were 402 tons in 1949, chiefly to the United States. Serious riots, resulting in the death of several Americans and Bolivians, began on May 29 at the Catavi mines of Patiño Mines & Enterprises Consolidated, Inc., which stopped operations at this mine and affected production at others. Order was virtually restored and production resumed at a curtailed rate July 15. A revolution began in August

and was quelled by early September. Fighting was reported in Cochabamba, Santa Cruz, Catavi, Potosi, and Oruro Departments. Tin mines continued operations, except for a few days. Some loss of exports of tin concentrates may have resulted from the temporary suspension of transportation facilities during the revolt.

No duties or taxes are applicable in direct form to the production of minerals in Bolivia, although mining companies must pay to the Bolivian Government specific taxes and duties on exports and annual profits. Taxes applicable to tin mined in the Department of Potosi, which are similar to those in other Departments, were published.[12]

A decree of January 6, 1949, provided for a tax of 1 cent per pound of fine tin exported, the proceeds to go for the expenses of constructing the Cochabamba-Santa Cruz highway. Following the protest made by the mining companies that taxes could not be imposed legally by decree, a modification acceptable to the miners was issued early in March, allowing payment of the new tax in bolivianos at the official rate of 42 bolivianos per dollar. Another export tax of 1 cent per pound of tin for the benefit of the Social Security Institute and a January decree providing that large and medium miners should pay in dollars for all purchases made on the local market were not enforced because of miners' protests. The cost of mineral production and exportation was increased considerably, however, by a freight raise granted the railroad companies by the Government in February in order that the railroads might meet new wage demands. Although the mining companies protested against the freight raise, all were paying it by the end of June, except the Patiño company which offered payment in bolivianos but still refused to pay the rate increase in foreign exchange.

Brazil.—The very small production of tin in Brazil recorded since 1943 has been mostly derived from placers. In the São João del Rei district of Minas Gerais numerous pegmatite dikes occur that contain tin. Through oxidation, decomposition, and erosion of these dikes, cassiterite has accumulated in the beds of a number of streams and rivers. The dikes dip at a rather steep angle and are seldom more than 1 meter wide. Other deposits of tin are found in the States of Paraiba, Rio Grande do Sul, Amapa, and São Paulo.

Output of tin plate at the Volta Redonda steel plant was reported at 6,319 tons in 1948 and estimated at 30,000 tons for 1949.

Burma.—Tin mining in Burma continued on a reduced scale in 1949, with production at about one-third the prewar rate. Mine output in 1949 was 1,781 long tons compared with 1,147 in 1948. Output decreased progressively throughout 1949 as internal disorders continued, with armed conflict in some parts of the country. Mining operations on an important scale were increasingly handicapped by dacoity.

Operations at the Mawchi Mines were suspended in June 1949 because of the political situation. From January to May the mine operated on a 30-ton-per-month basis, and by the middle of 1949, 200 long tons of tin and tungsten concentrates were mined. When operations ceased in June, more than 340 tons of concentrates were stored at Mawchi and 60 tons at Toungoo. Inability to dispose of

[12] Bureau of Mines, Mineral Trade Notes: Vol. 28, No. 1, January 1949, pp. 18-22.

the ore on hand created a serious financial crisis, which was relieved only by raising £150,000 in new capital in London to resume operations when the political situation permits.

All Anglo-Oriental-Malaya, Ltd., tin dredges in the Tavoy area have been closed by guerillas. The company said that its three dredges were not inoperative and that no one knew whether or not they had been damaged.

France.—Very little tin has been mined in France; the highest annual output until 1947 was 26 long tons of concentrates in 1917. However, in 1947 the tin content of ore mined was 43 long tons, 84 tons in 1948, and 73 tons in 1949. Occurrences are known in the Departments of Morbihan and Loire-Inferieure in Brittany and at Montebras, Vaulry, Cieux, Chanteloube, Meymac, Puy-les-Vignes, and Charrier on the Central Plateau.

The old mines at Nosay, Abbaretz, and surrounding villages in the Department of Loire-Inferieure (about 25 miles north of Nantes) are being reopened and worked by open-cast methods. Purchases of equipment are being financed with Marshall Plan credits. It has been reported that a workers' city will be built in the vicinity of the mines at Bois-Ver d'Abbarets. The mines are being operated by the Ste. Nantaize des Mineralis de l'Ouest, with American and foreign equipment, etc., estimated to cost between $325,000 and $350,000, plus £75,000 and 40 million Belgian francs. Under the long-term Organization for European Economic Cooperation (OEEC) plan, ending in 1952–53, production is expected to increase from 80 tons a year to 600 tons by 1952.

Indonesia.—Production of tin in concentrates in Indonesia totaled 28,965 long tons in 1949, a decrease of 5 percent from 1948. Failure to attain an original goal of 41,000 tons was attributed to a number of separate strikes, thefts of tin ore (which were estimated at 400 tons during the last half of 1949), and shortages of essential spare parts and other materials. Tin is produced on the islands Banka, Billiton, and Singkep, which in 1949 accounted for 57, 34, and 9 percent, respectively, of the total output. The basic labor force was 17,400 at Banka, 8,100 at Billiton, and 2,000 at Singkep. From 40 to 50 percent of these workers are Chinese.

Exports of tin in concentrates were about 30,459 long tons, of which 18,099 tons were shipped to the Netherlands, 12,352 tons to the United States, and 8 tons to Malaya.

The Indonesian Government controls all the production from Banka and five-eighths of the shares of the other producing company (N. V. Gemeenschappelijke Mijnbouwmaatschappij Billiton).

Malaya Federation.—The tin-mining industry in Malaya continued to record a progressive increase during 1949, despite the prevalence of terrorism. Mine production of tin in ore was 54,910 long tons in 1949, compared with 44,815 in 1948; 84,082 in the peak year of 1940; an annual average of 55,309 per year during the prewar period 1935–39. An output of 5,006 tons was made in March, the highest postwar rate, owing mainly to increased output from dredges.

The state of emergency declared in July 1948 continued. There have been fewer labor troubles since then, as most of the mines have been defended against terrorism by special police constables. Communist bandit attacks on properties decreased toward the end of the

year. These attacks, while contributing to supervision difficulties, caused little material damage. Unfortunately, there was some loss of life among tin miners. Delivery of plant and mining equipment from overseas improved; but there were long delays, especially as regards electrical equipment. Delivery dates from the United States were generally better than from the United Kingdom, but industrial disputes caused further delays from Australia. Wherever possible, efforts were made to encourage supplies from sterling areas. During the year 53 mining properties resumed operation, bringing the total worked to 686 when the year closed (there were more than 1,000 before the war). The labor force employed in tin mining had been increased from 46,858 at the beginning of 1949 to 47,107 at the year's end (not including 19,306 dulang washers in 1949).

Prewar rehabilitation plans progressed toward the goal of 80 dredges and 550 gravel-pumping mines to be in operation by 1950. There were no indications of any plans for expanding plant beyond prewar capacity. During 1949 the number of dredges increased from 67 in January to 76 in December. This means accounted for 27,673 long tons, or half the 1949 production. (The Storke report estimated that 40,500 tons or 55 percent of the 73,500-ton total set for 1949 would come from dredges.) Before World War II, dredging averaged 47 percent of annual production and was 52 percent in 1940, the peak year. Gravel-pumping mines increased from 464 at the beginning to 518 at the end of 1949, with production of 19,242 tons of tin—13 percent more than the Storke report estimate. Financial aid for the industry continued during 1949, but on a smaller scale. Rehabilitation loans through the Colonial Office—Ministry of Supply, London, to European-owned mines have amounted to S$49,609,525. Loans during 1949 totaled S$152,788. In addition, Chinese Tin Mines Rehabilitation Loans Board advances have been made to 363 mines, of which 286 were producing at the end of 1949. Up to the end of 1949, loans totaling S$78,514,661 had been advanced by the Government.

The principal source of pig tin in the world in 1949 was Malaya—from the large smelting plants of the Eastern Smelting Co., Ltd., Penang, and Straits Trading Co., Singapore. These plants increased their output 26 percent and supplied 37 percent of the world smelter production in 1949. Concentrates treated were derived mostly from Malaya, with smaller tonnages from Thailand, Burma, Indonesia, and French Indochina. The tin content of concentrates available from Malaya was 55,448 long tons compared with 44,792 in 1948. Imports originating elsewhere contained 6,560 tons of tin against 3,517 in 1948. The plants shipped 54,783 tons of metal (about 56 percent from Penang and 44 percent from Singapore). Nearly 80 percent went to the United States in 1949. Stocks of tin metal increased from 7,148 tons at the beginning of 1949 to 15,103 at the end, while stocks of tin in concentrates increased from 5,045 tons at the beginning to 5,222 at the end. The smelter of Tan Ban Joo, Ltd., Puda, Kuala Lumpur, which resumed operation in January 1948, smelted 515 piculs of tin ore during 1949, mostly for local consumption.

During 1949 the Ministry of Supply, London, continued to be the sole purchaser of exported tin metal until November 15, when the free market was reintroduced. From the latter part of September until November 15, the price depended upon sales by the Ministry of Supply

on tin delivered during that period. The Singapore market reopened to deal in tin on November 16, after being closed for nearly 8 years.

Nigeria.—The Colony and Protectorate of Nigeria, including the Cameroons under British trusteeship, is the largest of the British possessions in West Africa. In area, including the trust territory of the Cameroons, it is about equal to the combined area of Texas, Oklahoma, and Arkansas (about 372,674 square miles). The tin deposits are situated chiefly in the northern Provinces—Plateau, Kabba, Niger, and Benue. Deposits currently worked are alluvial or eluvial and are mined by placer methods. Lode-tin deposits are known to occur. Production has trended downward since 1944. Output of tin in concentrates in 1949 was 4 percent less than in 1948. The larger producing companies include: Jantar Nigeria Co., Ltd.; Minerals Research Syndicate; Bisichi Tin Co., Ltd.; Amalgamated Tin Mines of Nigeria, Ltd.; Gold & Base Metals Mines of Nigeria, Ltd.; United Tin Areas of Nigeria, Ltd.; African Prospectors, Ltd.; and Naraguta Tin Mines, Ltd. Most of the world supply of columbium is produced as a byproduct of tin mining in Nigeria. All the tin concentrates are sold to the United Kingdom, having been purchased by the British Ministry of Supply until the reopening of the London Metal Exchange November 15, 1949.

Thailand.—Rehabilitation of dredges continued in 1949. Production in 1949 increased 84 percent to 7,815 tons compared with 4,240 in 1948. The number of dredges operating increased from 19 in January to 30 in December.[13]

Production of tin increased steadily during 1949 as Thai Government rehabilitation loans made possible the purchase and importation of spare parts for dredge repairs. Devaluation of the pound sterling and subsequent adjustment of the bath/pound sterling rate at 35 : 1 affected tin royalties based on Singapore prices, and official revenue declined; at the same time, world market prices fell. Thai officials reviewed their plans to revise all Thai mining laws, including those pertaining to royalty levies, with a view to protecting State revenues and to encourage investment of foreign capital. At the end of the year, in order to stimulate sales of tin ore to dollar markets and to encourage increased production, the Cabinet considered revision of regulations requiring tin exporters to surrender half of their foreign exchange proceeds to the Bank of Thailand. On January 24, 1950, a notification was issued permitting exporters to retain 60 percent of their foreign exchange proceeds.

United Kingdom.—Geevor and South Crofty continued to be the only mines active. Some development work was being carried on at the Castle-an-Dinas and New Consols mines. In Cornwall the British Malayan Tin Syndicate operated its Basset property. Mine production totaled 1,217 long tons in 1949 compared with 1,281 in 1948. The United Kingdom smelter production of tin was the third largest in the world in 1949. Output declined 8 percent compared with 1948, mostly accountable to a large falling off in receipts of concentrates from Bolivia. Year-end stocks of tin in concentrates were 6,080 tons (6,386 at beginning of year) and as metal 14,682 tons (10,592 at beginning). Total stocks, including tin metal and concentrates

[13] Bureau of Mines, Mineral Trade Notes: Vol. 31, No. 3, September 1950, pp. 21-23.

afloat and visible consumers' stocks, were reported to be 23,138 tons at the end of 1949, an 11-percent increase compared with the 20,937 tons at the beginning.

The United Kingdom is the second-largest tin consumer in the world. British Ministry of Supply Control of Tin Order 6 (revocation), 1949, freed tin from its control November 15, and the Board of Trade announced (Export of Goods Control Amendment 7) that tin in certain forms (but not alloys, ores, or concentrates) was free from export licensing control. Total virgin tin consumed was 20,823 tons, 18 percent less than in 1948. The use of tin for making tin plate, the principal finished product, was virtually unchanged from 1948. Hot-dipped tin-plate production declined nearly 1 percent, but electrolytic tin plate, accounting for 10 percent of production, increased 60 percent in 1949. The consumption of tin for most of the other uses in 1949 was the lowest since the war.

On November 15, 1949, the London Metal Exchange reopened for dealings in tin. The situation prevailing at the time was one of extreme complexity. The British Ministry of Supply was the only holder of any stocks. In the first morning's trading, cash tin was at £725 per ton and forward at £660—a tremendous backwardation, which was more or less the state of affairs at the end of the year. Until the reopening of the exchange, the Ministry of Supply fixed the price of standard tin at £572½, and after devaluation of the pound the price was raised to £757.

Titanium

By Helena M. Meyer

GENERAL SUMMARY

THE YEAR 1949, like 1948, was characterized by widespread interest and research in connection with the production of titanium metal and alloys. The unprecedented amount of money and effort being expended by Government and industry in experimental work are largely responsible for the many predictions that titanium will find large-scale use much more rapidly than its predecessor metals. More than one authority predicted during the year that titanium and titanium alloys would become primary structural materials within 10 years. The problem of producing metal at a price low enough to attract production and consumption in large quantities remains to be solved. In 1949 titanium metal was produced commercially for the second successive year and on an increasing scale. One pilot plant operated continuously at approximately 100 pounds a day throughout the year, and a second pilot plant of somewhat larger capacity went into production near the close of the year. Other pilot plants were under construction at the year end, and the Bureau of Mines continued production of metal at Boulder City, Nev., throughout the year.

The titanium industry, in addition to the enthusiasm and energy expended in connection with the metal, was featured by new maximum production and shipments of ilmenite for the third successive year, by new peak imports, and by unprecedented output and shipments of rutile. However, 1949 was the first year in 7 that a new high ilmenite consumption record was not established. Rising inventories of crude materials were recorded also.

Present world sources of ilmenite and expected additions in the next year or two promise more than adequate supplies for present pigment needs, the only large tonnage use. Possibilities for expansion in requirements for the production of metal, however, as well as for potential growth in consumption in pigments, as a result of hoped-for improvement in world living standards particularly outside of the United States, are such that it is not safe to forecast that anticipated world supplies for the next several years will greatly exceed world requirements.

Production and shipments of ilmenite were 5 and 2 percent, respectively, greater than in 1948, following 14-percent gains for both in that year. Imports were 34 percent higher than in 1948 and 8 percent above the earlier peak in 1947. Domestic shipments and imports together were 40 percent above consumption, resulting in a 33-percent rise in industry stocks. Inventories at the end of 1949 were equivalent to 1.4 years' needs at the 1949 rate of use.

Titanium pigments, which take 99 percent of the ilmenite consumed in the United States, declined 6 percent in output and 9 percent in shipments in 1949. The drop in general industrial activity in midyear adversely affected use of titanium pigments; but this class of

pigments fared much better than other white pigments, namely white lead (dry and in oil), zinc oxide (lead-free and leaded), and lithopone, shipments of which declined 41, 33, and 44 percent, respectively, in 1949 as compared with 1948.

Production and shipments of rutile were 62 and 7 percent, respectively, larger than in 1948 and thus established new peaks. Some of the material covered, however, was not consumed for customary rutile purposes (see section on Domestic Production). Imports of rutile were little more than one-third of the reduced quantity entered in 1948. Supplies from domestic and foreign sources were more than adequate for the increased requirements in 1949, and inventories rose 18 percent. Stocks at the year end would fill United States needs at the 1949 rate of consumption for 11 months.

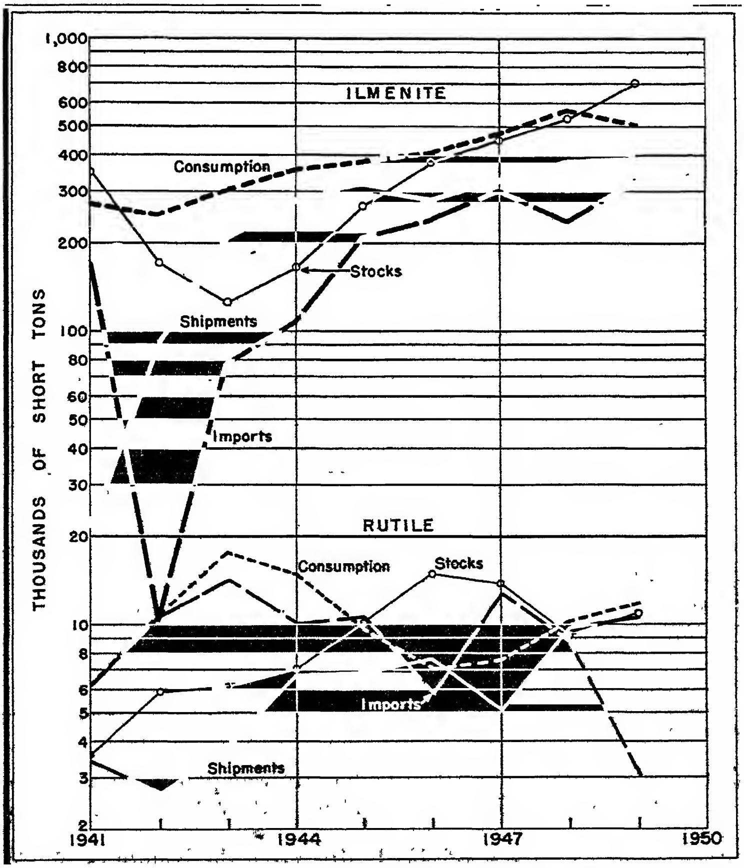

FIGURE 1.—Trends in ilmenite and rutile shipments, imports, consumption, and stocks, 1941–49.

Quotations for both ilmenite and rutile trended downward in 1949, a reflection of the ample supply of these concentrates in that year. The average quotation per gross ton for ilmenite containing 56-59

percent TiO_2, f. o. b. Atlantic seaboard, dropped from a range of \$18–\$20, according to grade and impurities, at the beginning of the year to \$14–\$16 in the first half of November and continued at this level beyond the year end. Quotations were nominal throughout the year. Nominal quotations for rutile, guaranteed minimum 94-percent concentrate, after continuing at 8–10 cents a pound for a number of years, fell to 6–8 cents in December 1948 and further to 4–5 cents by the end of 1949.

Progress toward bringing into production an ilmenite property that will rank with the world's largest producers and may exceed all others was reported in 1949. This is the property of the Quebec Iron & Titanium Corp. (owned by the Kennecott Copper Corp. and the New Jersey Zinc Co.) in the Allard Lake area of Quebec, Canada.

DOMESTIC PRODUCTION

Production and shipments of ilmenite rose 5 and 2 percent, respectively, in 1949, and both established new records for the third successive year. Rutile likewise reached new peaks in both classes, but rutile in 1949 includes a quantity of mixed product containing altered ilmenite, leucoxene, and rutile. The mixed product more nearly resembles rutile than ilmenite in TiO_2 content but was used in the manufacture of titanium pigments and metal. Total shipments of ilmenite ranged from 44 to 64 percent TiO_2 and of rutile from 84 to 96 percent TiO_2.

Arkansas.—Several recent reports [1] of the Bureau of Mines referred to titanium in Arkansas.

Production and mine shipments of titanium concentrates from domestic ores in the United States, 1940–44 (average) and 1945–49, in short tons

Year	Ilmenite				Rutile			
	Production	Shipments			Production	Shipments		
		Gross weight	TiO_2 content	Value		Gross weight	TiO_2 content	Value
1940–44 (average)	120,667	125,626	56,628	\$2,659,256	3,915	3,890	3,617	\$599,394
1945	308,516	308,518	141,852	7,359,170	7,179	6,837	6,414	869,920
1946	282,447	282,708	130,624	4,878,917	7,453	7,514	7,046	996,989
1947	336,533	336,061	157,328	5,029,490	8,562	5,157	4,813	533,548
1948	383,745	381,508	177,447	5,793,973	7,380	9,907	9,226	647,334
1949	402,334	389,234	186,535	6,212,348	[1] 11,988	[1] 10,559	[1] 9,414	489,798

[1] Includes a mixed product containing altered ilmenite, leucoxene, and rutile.

California.—A small quantity of ilmenite was produced at the property of the Ferro-Titan Minerals Co., Sun Valley, Los Angeles County, Calif.

Florida.—The property of E. I. du Pont de Nemours & Co. at Starke, Fla., began to produce ilmenite and a mixed product contain-

[1] Reed, Donald F., Investigation of Christy Titanium Deposit, Hot Spring County, Ark.: Bureau of Mines Rept. of Investigations 4592, 1949, 10 pp. Investigation of Magnet Cove Rutile Deposit, Hot Spring County, Ark.: Bureau of Mines Rept. of Investigations 4593, 1950, 9 pp.

Calhoun, W. A., Titanium and Iron Minerals from Black Sands in Bauxite: Bureau of Mines Rept. of Investigations 4621, 1950, 16 pp.

ing altered ilmenite, leucoxene, and rutile in March 1949. The mixed product is included in this report in the rutile tonnages because it more nearly resembles rutile in TiO_2 content, although it was used in 1949 to make pigments and metal. The addition of this product to rutile resulted in raising United States production and shipments to the highest annual quantities on record. A report [2] on titanium in Florida was recently released. According to this report, the du Pont property was expected to produce 100,000 tons of titanium products annually. As a result of the disclosure of a large concentration of heavy minerals in Trail Ridge, owing to drilling by the Bureau of Mines and extensive investigation by du Pont, as well as indication of the possibility of similar occurrences elsewhere, the drilling of other locations within the State was begun in August 1947. This exploration was completed in April 1948, and results were described in the aforementioned report.

Production of ilmenite and rutile came again from the Rutile Mining Co. of Florida near Jacksonville and from the property of the Florida Ore Processing Co. near Melbourne.

New York.—Production of ilmenite at Tahawus, Essex County, N. Y., by the National Lead Co. in 1949 slightly exceeded that in 1948 and thus established a new peak by a narrow margin. This property continued to be the leading producer in the world. A brochure prepared by the company, dated August 29, 1949, for distribution to an inspection party of the United Nations Conference on Conservation and Utilization of Resources, contained the following paragraph on production:

> Since beginning operation in 1942, 7,000,000 tons of ilmenite-magnetite ore have been mined from the MacIntyre open-cut. To accomplish this 5,000,000 tons of rock and soil were removed from this immediate area to make this ore available for open-cut mining. From this ore 1,000,000 tons of ilmenite and 3,000,000 tons of magnetite concentrates were produced. All of the ilmenite was shipped directly to processing plants, while 1,000,000 tons of the magnetite (iron ore) have been converted to sinter and 500,000 tons have been shipped as raw concentrate to various iron, steel and other manufacturers. At present, 1,500,000 tons of magnetite remain in stockpiles at the plant and are currently being shipped to steel companies.
>
> Technical progress is disclosing new uses for titanium and its derivatives, one of the most recent being the use of the metal itself in uses which combine the properties of stainless steel and aluminum. This promises increased demand for titanium ores, and continued operation of the MacIntyre Development for many years to come, with all the attendant benefits to its employees, the community in general, other supplier industries, the people of the State of New York, and the Nation.

North Carolina.—The Yadkin Mica & Ilmenite Co., subsidiary of the Glidden Co., produced 31,364 tons of ilmenite (averaging 51 percent TiO_2) at Finley, Caldwell County, N. C., and shipped 31,714 tons. The 1949 output and shipments were 8 and 10 percent, respectively, above 1948. Production in 1949 was at a new record rate, marked a continuous rise since 1946, and was 83 percent above that year.

Virginia.—Ilmenite and rutile were produced again in 1949 near Roseland, Nelson County, Va., by the American Rutile Corp., subsidiary of the Metal & Thermit Corp. This property closed in July;

[2] Thoenen, J. R., and Warne, J. D., Titanium Minerals in Central and Northeastern Florida: Bureau of Mines Rept. of Investigations 4515, 1949, 62 pp.

the corporation was in process of liquidation early in 1950 owing to the fact that the grade of ore mined at Roseland is too low to be profitable. The Calco Chemical Division of American Cyanamid Co. continued to produce ilmenite at Piney River, also in Nelson County.

CONSUMPTION AND USES

Consumption of ilmenite dropped 10 percent in 1949 and thus failed to establish a new peak for the first time in 7 years; except for 1948, the rate of use in 1949 was at a higher level than ever before. The manufacture of pigments, as usual, took 99 percent of all ilmenite consumed. In addition a high percentage of the rutile used was consumed in the manufacture of pigments. Actually the material so used was a mixed product containing altered ilmenite, leucoxene, and rutile, which in titanium dioxide content resembled rutile more closely than ilmenite. The total tonnage shown as rutile was 16 percent above 1948, but the quantity for customary rutile uses dropped in 1949.

Consumption of ilmenite and rutile in the United States, 1941–46 (total) and 1947–49, by poducts, in short tons

Product	Ilmenite		Rutile	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
1941	275,106	150,966	6,361	5,986
1942	257,535	141,412	10,616	9,952
1943	302,822	142,868	17,634	16,451
1944	360,941	175,475	14,813	13,837
1945	381,178	187,580	9,791	9,144
1946	404,283	202,663	7,134	6,670
1947				
Pigments (manufactured titanium dioxide) [1]	473,154	248,231		
Welding-rod coatings [1]	144	74	6,425	5,907
Alloys and carbide	5,972	2,431	1,131	1,050
Ceramics			102	95
Miscellaneous	254	123	34	31
Total consumption	479,524	250,859	7,692	7,083
1948				
Pigments (manufactured titanium dioxide) [1]	558,448	297,728	(2)	(2)
Welding-rod coatings [1]	145	72	7,885	7,289
Alloys and carbide	6,377	2,591	952	889
Ceramics			175	166
Miscellaneous	30	17	[3] 1,218	[3] 1,144
Total consumption	565,000	300,408	[4] 10,230	[4] 9,488
1949				
Pigments (manufactured titanium dioxide) [1]	505,432	265,854	(2)	(2)
Welding-rod coatings [1]	165	85	6,399	5,904
Alloys and carbide	4,969	2,037	660	619
Ceramics			143	136
Miscellaneous	42	24	[5] 4,686	[5] 4,204
Total consumption	510,608	268,000	[5] 11,888	[5] 10,863

[1] "Pigments" include all manufactured titanium dioxide, consumption of which in welding-rod coatings was 1,[illegible]57 tons in 1947, 1,338 tons in 1948 and 1,082 tons in 1949.
[2] Bureau of Mines not at liberty to publish; figures included in "Miscellaneous."
[3] Revised figures. Includes rutile used to make pigments.
[4] Revised figures
[5] Includes a mixed product containing altered ilmenite, leucoxene, and rutile, used to make pigments and metal.

Titanium Pigments.—Production and shipments of titanium pigments in 1949 dropped somewhat from 1948, following the establishment of five successive peaks; except for 1948, both items were at the highest annual rates ever attained. Figures on this industry are supplied in confidence and, consequently, are not given here. As already stated, a mixed product containing altered ilmenite, leucoxene, and rutile, produced at a domestic mine was used in 1949 chiefly in the manufacture of pigments.

Distribution of titanium pigments shipments, by industries, 1935–49, in percent of total

Year	Paints, varnishes, and lacquers		Floor coverings (linoleum and felt base)		Coated fabrics and textiles (oilcloth, shade cloth, artificial leather, etc.)		Rubber		Paper		Printing ink		Other		Total	
	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content
1935	73.7	64.8	2.0	3.5	3.7	4.8	4.6	4.2	6.8	9.4	1.2	2.0	8.0	11.3	100.0	100.0
1936	77.4	66.7	2.1	3.8	4.9	6.2	3.2	3.6	7.0	10.6	1.2	2.1	4.2	7.0	100.0	100.0
1937	79.4	69.1	2.0	3.7	4.1	4.9	3.3	3.9	6.4	9.8	1.1	1.8	3.7	6.8	100.0	100.0
1938	76.8	65.9	2.6	4.7	3.5	4.3	3.7	4.2	8.9	13.1	1.2	2.0	3.3	5.8	100.0	100.0
1939	76.9	66.5	3.3	5.3	3.4	4.1	3.6	4.3	7.7	11.1	1.1	1.9	4.0	6.8	100.0	100.0
1940	76.4	66.7	3.6	5.3	2.7	3.3	3.0	3.7	6.9	10.4	1.0	1.7	6.4	8.9	100.0	100.0
1941	78.0	70.8	3.1	4.4	2.8	3.3	2.8	3.5	6.2	9.2	1.0	1.7	6.1	7.1	100.0	100.0
1942	79.1	71.3	2.6	3.6	2.7	3.5	.8	1.0	5.3	7.6	.8	1.4	8.7	11.6	100.0	100.0
1943	78.0	69.5	2.4	3.1	1.9	2.6	.8	1.1	6.7	9.5	1.0	1.7	9.2	12.5	100.0	100.0
1944	79.1	71.9	2.0	2.7	1.9	2.4	.7	1.0	6.4	8.6	.8	1.4	9.1	12.0	100.0	100.0
1945	79.7	73.4	2.0	2.5	1.5	2.0	1.1	1.6	6.7	9.3	.9	1.4	8.1	9.8	100.0	100.0
1946	78.6	71.9	2.5	3.1	1.8	2.3	2.0	2.8	6.1	8.6	.9	1.5	8.1	9.8	100.0	100.0
1947	81.5	74.3	3.7	4.7	2.1	2.6	2.6	3.4	5.5	7.8	.9	1.5	3.7	5.7	100.0	100.0
1948	76.4	69.9	4.5	5.9	2.1	2.7	2.5	3.2	5.4	7.4	.9	1.4	8.2	9.5	100.0	100.0
1949	74.5	67.5	4.6	5.8	1.6	2.1	3.1	3.9	6.6	9.6	.9	1.4	8.7	9.7	100.0	100.0

Metal.—Titanium metal was produced on a commercial basis at Newport, Del., by E. I. du Pont de Nemours & Co. for the second successive year. One pilot plant was operated continuously at approximately 100 pounds a day throughout the year and a second pilot plant of somewhat larger capacity went into production near the close of the year. Bureau of Mines produced metal at the rate of 200 pounds a week, except for several brief interruptions. Early in the year most of the output was in the form of powder, but at the end of the year production was largely in the form of sponge. A pilot plant for metal production was under construction at Sayreville, N. J., by the National Lead Co. at the end of 1949 and began to produce early in 1950. The potential uses of titanium metal were recently discussed.[3] The authors indicated that although this relatively new metal with unique and highly desirable properties has a promising future, its production today is too costly to warrant the conclusion that it will have almost

[3] Ralston, Oliver, and Cservenyak, F. J., Potential Uses of Titanium Metal: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 214–218.

universal applications and compete with steel, aluminum, and copper where these cheaper metals can function satisfactorily.

Welding-Rod Coatings.—Production of titanium-coated welding rods was 154,000 short tons in 1949, a drop of 18 percent from the 188,000 tons for 1948; 153,000 tons were coated in 1947, 133,000 in 1946, and 481,000 in 1943. Of the 1949 tonnage, 54 percent was coated with natural rutile, 33 percent with manufactured titanium dioxide, and nearly 7 percent each with both varieties and with ilmenite.

Other Uses.—In a recent article[4] it was pointed out that alkyl titanates, derived from the action of titanium tetrachloride on alcohols, are very effective waterproofing agents. These compounds, the titanium analogs of alkyl silicates, are capable of imparting a water-repellent finish to such diverse materials as paper, cotton, wool, rayon, nylon, silk, felt, and wood.

An article[5] stated that, although the superior qualities of titanium dioxide as an opacifier have been known for many years, its commercial utilization as the major opacifying agent in porcelain enamels is a comparatively recent development. The development and physical properties of these enamels were discussed. The fact that the enamels are applied directly to the metal without the need of an intermediate ground coat was said to be an outstanding development. Another article[6] discussed the standards and practices that permit application of titanium enamel to steel without the use of a ground coat. A development of increasing scientific and technical importance, another article[7] stated, was the electromechanical effect exhibited by barium titanate ceramics under the influence of a high electric polarizing field. Titanate ceramics, the author said, have become an important raw material for the manufacture of capacitors, especially in certain types of high-voltage condensers, such as those used in televison sets.

Titanium carbides were discussed in articles[8] appearing recently. Experiments were conducted on the preparation of metal-ceramic seals by use of brazing alloy and a flux of titanium hydride in an atmosphere of highly purified hydrogen.[9]

Efforts to form single crystals of rutile were described[10] in recent literature. Synthetic rutile for use as gem stones is an outgrowth of such investigations.

STOCKS

Inventories of ilmenite rose 33 percent in 1949 and were equivalent to 15 months' requirements at the record rate of consumption maintained in 1948; they were adequate for 17 months at the 1949 rate.

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[4] Speer, Robt. J., and Carmody, D. R., Organic Compounds of Titanium: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp 251–253.

[5] Spencer-Strong, G. H., and Patrick, Robt. F., Titanium in Porcelain Enamels: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 253–256.

[6] Swartz, John C., Titanium Enamel to Titanium Steel: Steel, vol. 124, No. 3, Jan. 17, 1949, pp. 64–65 and 96.

[7] Jaffe, Hans, Titanate Ceramics for Electromechanical Purposes: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 264–268.

[8] Redmond, Joyn C., Cemented Titanium Carbide: Jour. Metals, vol. 1, No. 12, December 1949, pp. 987–993.

Rose, Kenneth, Cemented Carbides: Materials & Methods, vol. 29, No. 2, February 1949, pp. 74–84.

[9] Metal Progress, Brazing Metals to Nonmetals: Vol. 57, No. 2, February 1950, pp. 261, 262 and 264.

[10] Moore, Chas. H., Jr., Formation and Properties of Single Rutile Crystals of Synthetic Rutile: Min. Eng., vol. 1, No. 6, June 1949, pp. 194–199.

Rutile stocks rose 18 percent in 1949 and would sustain industry at the 1949 rate of use for 11 months.

Stocks of titanium concentrates in the United States at end of year, 1948–49, in short tons

Stocks	1948				1949			
	Ilmenite		Rutile		Ilmenite		Rutile	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
Mine	3,983	1,800	1,500	1,399	16,933	7,569	2,952	2,750
Distributors [1]	4,499	1,809	4,218	3,986	2,478	1,026	4,329	4,090
Consumers	522,077	250,559	3,493	3,255	683,635	332,156	3,586	3,148
Total stocks	530,559	254,168	9,211	8,640	703,046	340,751	10,867	9,988

[1] Includes ilmenite and rutile content of mixed zirconium-titanium concentrates.

PRICES

The average E&MJ Metal and Mineral Markets quotation per gross ton for ilmenite containing 56–59 percent TiO_2, f. o. b. Atlantic seaboard, dropped from a range of \$18–\$20, according to grade and impurities, at the beginning of the year to \$16–\$18 in early October, to \$15–\$17 late in that month, and further to \$14–\$16 in the first half of November. There were no further changes in 1949. Quotations were given as nominal. Nominal quotations for rutile, guaranteed minimum 94-percent concentrate, after continuing at 8–10 cents a pound for a number of years fell to 6–8 cents in December 1948, to 4–6 cents in May 1949, and further to 4–5 cents by the end of the year.

According to the magazine Steel, quotations for ferrotitanium were unchanged throughout 1949, as follows:

Ferrotitanium, Low-Carbon: (Ti 20–25 percent, Al 3.5 percent maximum, Si 4 percent maximum, C 0.10 percent maximum). Contract, ton lots, 2″ x D, \$1.40 per pound of contained Ti; less ton \$1.45. (Ti 38–43 percent, Al 8 percent maximum, Si 4 percent maximum, C 0.10 percent maximum). Ton lot \$1.28, less ton \$1.35, f. o. b. Niagara Falls, N. Y., freight allowed to St. Louis. Spot add 5¢.

Ferrotitanium, High-Carbon: (Ti 15–18 percent, C 6–8 percent). Contract \$160 per net ton, f. o. b. Niagara Falls, N. Y., freight allowed to destination east of Mississippi River and north of Baltimore and St. Louis.

Ferrotitanium, Medium-Carbon: (Ti 17–21 percent, C 3–4.5 percent). Contract, \$175 per ton, f. o. b. Niagara Falls, N. Y., freight not exceeding St. Louis rate allowed.

Titanium metal, 96–98 percent, was quoted at \$5–\$6 a pound from mid-September 1948 through September 1949, after which it was quoted for the remainder of the year at \$5.

Manufactured titanium dioxide (anatase), chalk-resistant, plain, and (rutile) nonchalking, in bags, carlots, delivered, were quoted in Oil, Paint and Drug Reporter throughout the year at 19½, 19½, and 21½ cents a pound, respectively. Beginning October 31, quotations on a ceramic grade were added; this grade was quoted at 19½ cents a pound from then to the end of the year.

FOREIGN TRADE [11]

From a tonnage standpoint, foreign trade in titanium materials is preponderantly of imports of the crude products, ilmenite and rutile. Exports are largely of titanium dioxide; the values of exports of this class and of ferrotitanium far exceed the combined values of receipts of ilmenite and rutile from abroad.

Imports.—Receipts of ilmenite established a new record in 1949, being 34 percent higher than in 1948 and 8 percent above the previous

Titanium concentrates [1] imported for consumption in the United States, 1940–44 (average) and 1945–49, by countries, in short tons

[U. S. Department of Commerce]

Country of origin	1940–44 (average)	1945	1946	1947	1948	1949
ILMENITE						
Australia [2]	214	1,753		[3] 1,659	(4)	
Brazil	2,102	10,508	2	1	8,708	
Canada	21,656	6,987	1,250	7,122	4,519	540
Ceylon	930					2
Egypt						721
India	89.981	179,693	218,623	262,503	184,309	289,739
Malaya					3,335	
Norway		9,895	21,077	30,026	41,248	33,155
Portugal	194					
Total as reported	115,077	208,836	240,952	301,311	242,119	324,157
Australia: In "zirconium ore" [2]	3,329	[5] 1,236	1,388			
Grand total	118,406	210,072	242,340	301,311	242,119	324,157
Value of "as reported"	$483,443	$1,217,339	$1,440,112	$1,791,020	[6] $1,758,848	$2,479,071
RUTILE						
Australia [2]	1,340	3,070	4,377	7,460	8,771	3,085
Brazil	2,826	234	31			
French Cameroon [7]	248			3		
India	190			113		
Norway					(4)	
Portugal	1					
Total as reported	4,605	3,304	4,408	7,576	8,771	3,085
Australia:						
In "zirconium ore" [2]	4,062	7,298	1,456			
In "ilmenite"				[3] 5,061		
Grand total	8,667	10,602	5,864	12,637	8,771	3,085
Value of "as reported"	$408,170	$98,170	$213,795	$468,810	$588,713	$179,746

[1] Classified as "ore" by the U. S. Department of Commerce.
[2] Most of the imports of titanium from Australia in 1940–47 were in mixed zircon-rutile ilmenite concentrates. Totals of mixed concentrates are derived by addition of the U. S. Department of Commerce figures for imports of ilmenite, rutile, and "zirconium ore" from Australia. These totals are apportioned by the Bureau of Mines (on the basis of surveys of importers) into the 3 component minerals. The excess quantities of ilmenite and rutile over the quantities reported by the U. S. Department of Commerce in those specific categories are entered as "In 'zirconium ore.'"
[3] Most of the ilmenite, rutile, and zircon from Australia in 1947 was imported in the form of zircon-rutile or zircon-rutile-ilmenite mixed concentrates. These concentrates (including separated concentrates of a single mineral) totaled 36,074 short tons, of which 1,659 were ilmenite, 12,521 rutile, and 21,894 zircon. For statistical convenience, it can be assumed that 5,061 tons of the material reported by the Department of Commerce as ilmenite was actually rutile; the value of this 5,061 tons of rutile, however, is inseparable from the ilmenite as reported.
[4] Less than 1 ton.
[5] Includes 209 tons not recovered from mixed concentrates.
[6] Revised figure.
[7] Includes quantities reported by the U. S. Department of Commerce as originating in French Equatorial Africa, from which no rutile production has been recorded.

[11] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

peak in 1947. Imports from India, always by far the dominant source, were likewise at a new top, having exceeded slightly the previous high in 1939. Imports from Norway, which had been rising, dropped 20 percent in 1949. Norway supplied 10 percent of the 1949 total and was the only source of consequence outside of India. Brazil and Malaya, which sent significant quantities to the United States in 1948, did not appear on import declarations in 1949. Only 38 short tons of ferrotitanium were entered in 1949, all from the United Kingdom.

All imports of rutile again were from Australia; little more than one-third of the 1948 quantity was received in 1949.

Exports.—Shipments of titanium materials from the United States consist largely of titanium pigments. The uptrend in exports of this item, in virtually continuous progress since the movement began prior to 1939, reached a new high level in 1949. Exports totaled 29,621 tons in 1949 or considerably more than double the quantity for 1945. Canada was by far the chief destination of titanium dioxide exports with 19,653 tons, and next in importance were Brazil with 1,577 tons, France 1,409, Belgium-Luxembourg 1,150, Mexico 959, Cuba 859, Netherlands 770, followed by 49 other countries with smaller quantities. Exports of concentrates totaled 1,505 tons, of which Canada received 904, Netherlands 386, Belgium-Luxembourg 132, and four other countries the remainder. Canada received 127 tons of the ferro-alloys exported and Belgium-Luxembourg 28; insignificant quantities went to six others.

Exports of titanium products from the United States, 1942–44 (average) and 1945–49, by classes

[U. S. Department of Commerce]

Year	Concentrates		Ferro-alloys		Dioxide and pigments		Tetrachloride and other compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1942–44 (average)	495	$91,220	[1] 658	[1] $101,828	9,853	$1,796,411	376	$223,984
1945	609	121,951	744	122,887	12,824	2,315,552	75	46,718
1946	1,385	200,866	550	63,723	16,314	3,092,607	(2)	(2)
1947	1,266	192,703	509	80,590	21,171	5,183,936	(2)	(2)
1948	1,454	187,225	480	82,874	26,824	7,126,956	(2)	(2)
1949	1,505	143,412	179	40,918	29,621	8,140,991	(2)	(2)

[1] Includes metal and nonferrous alloys.
[2] Beginning Jan. 1, 1946, not separately classified.

TECHNOLOGY

Treatment of titaniferous ores was the subject of reports published[12] recently.

Progress in research work on the development of a new method for

[12] Armant, D. L., and Cole, S. S., Laboratory Smelting of Titaniferous Ores: Jour. Metals, vol. 1, No. 12, December 1949, pp. 909–913.
MacMillan, Robt. T., Dinnin, Jos. L., and Conley, John E., Proposed Process for Treatment of Low-Grade Titaniferous Ores: Bureau of Mines Rept. of Investigations 4638, 1950, 19 pp.

preparing lower-cost titanium tetrachloride and preparing titanium oxide pigment was reported[13] in 1949.

Bureau of Mines production of metallic titanium was described.[14] The report states that—

> To produce ductile titanium by powder metallurgy, the method used by the Bureau, it is necessary to start with powder free from gaseous impurities. Although hydrogen, if present, can be removed completely enough for all practial purposes by heating the metal in a high vacuum, no method of removing nitrogen or oxygen is yet known. To prevent contamination, therefore, the titanium tetrachloride from which the powder is produced is treated in equipment so designed that the titanium comes in contact only with iron and helium during production. After it has cooled to room temperature, exposure of titanium to air does no material harm.

The history of titanium tetraiodide was recently reviewed[15] and a new method of its preparation described. The authors stated:

> The practical importance of titanium tetraiodide increased greatly when van Arkel and de Boer showed that it could be thermally decomposed by impingement of the vapors on a highly heated tungsten wire, with the building up of a rod of pure titanium metal and the liberation of elementary iodine. To date, the best ductile titanium metal has been produced by the van Arkel-deBoer method.

Several recent articles[16] bore on the properties of titanium metal and also on the effects of other elements thereon. A résumé of current findings in connection with titanium and titanium alloys was recently made available.[17] Many other articles on titanium alloys also were released, of which some are listed.[18]

WORLD REVIEW

Available data on world production of ilmenite and rutile in recent years are shown in the accompanying table.

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[13] Knickerbocker, R. G., Gorski, C. H., Kenworthy, H., and Starliper, A. G., Titanium Investigations: Research and Development Work on the Preparation of Titanium Chloride and Oxide from Titanium Mattes: Jour. Metals, vol. 1, No. 11, November 1949, pp. 785–791.

[14] Wartman, F. S., Walker, J. P., Fuller, H. C., Cook, M. A., and Anderson, E. L., Production of Ductile Titanium at Boulder City, Nev.: Bureau of Mines Rept. of Investigations 4519, 1949, 37 p.

[15] Blumenthal, Warren B., and Smith, Howard, Titanium Tetraiodide: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 249–251.

[16] Gee, E. A., and Golden, L. B., Titanium and Zirconium Corrosion Studies: Ind. Eng. Chem., vol. 41, No. 8, August 1949, pp. 1668–1673.

Jaffee, Robt. I., and Campbell, I. E., The Effect of Oxygen, Nitrogen, and Hydrogen on Iodide-Refined Titanium: Jour. Metals, vol. 1, No. 9, September 1949, pp. 646–654.

Fuller, F. B., Some New Data on the Properties of Wrought Titanium: Metal Progress, vol. 56, No. 3, September 1949, pp. 348–350.

Gee, E. A., Sutton, J. B., and Barth, W. J., Effect of Carbon in Titanium Metal Ingots: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 243–249.

[17] Steel, Titanium and Titanium Alloys: Vol. 124, Nos. 25 and 26, June 20 and June 27, 1949, pp. 101–104, 132, 135, and 58–61, 92, 94.

[18] Kuhn, W. E., Kinsey, H. V., and Ellis, O. W., A Study of Some Alloys of Titanium: Canad. Min. and Met. Bull., vol. 43, No. 454, February 1950, pp. 74–87.

Gonser, Bruce W., Titanium Alloys: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 222–226.

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World production of titanium concentrates (ilmenite and rutile), by countries, in metric tons, 1943–49

[Compiled by Pauline Roberts]

Country	1943	1944	1945	1946	1947	1948	1949
ILMENITE							
Australia:							
New South Wales	3,815	3,590	2,485	1,636	[1] 3,551	[1] 7,489	[1,2] 4,599
Queensland	1,655	3,697	4,186	4,258	[1] 2,934	[1] 4,318	[1,2] 2,752
Tasmania					844		
Brazil (exports)		3,250	5,000			7,900	(3)
Canada	62,992	30,820	12,834	1,275	6,445	4,029	
Egypt		9	46	146		1,034	(3)
India	38,396	102,412	174,848	187,993	257,476	233,098	(3)
Malaya					[4] 13,201	12,909	20,034
Norway	66,191	63,975	28,312	52,574	69,711	93,322	(3)
Portugal	121		301	633	243	155	680
Senegal [5]	730		3,200	4,191	11,282	3,690	8,338
Spain	178	548	216	128	150	181	311
United States	184,657	252,749	279,880	256,230	305,296	348,126	364,989
Total ilmenite	358,735	461,050	511,308	509,064	671,223	716,251	(3)
RUTILE							
Australia:							
New South Wales	4,828	4,597	5,292	4,876	9,068	[1] 7,110	[1,2] 5,591
Queensland	1,902	4,246	4,609	3,407	4,338	[1] 6,411	[1,2] 3,358
Brazil (exports)	4,557	1,564	160	28	5		(3)
French Cameroon	2,735	3,320	1,440	1,260	755	(3)	403
India	2,396	1,672	620	262	159	129	(3)
Norway	116	85	76	63	51		(3)
United States	3,617	6,279	6,513	6,761	7,767	6,695	10,875
Total rutile	20,151	21,763	18,710	16,657	22,143	21,000	20,400

[1] Excludes content of beach sand in stock dumps.
[2] January to September, inclusive.
[3] Data not available.
[4] Exports.
[5] Approximately 20 percent of ilmenite concentrates is zircon.

Australia.—A plant for the production of titanium pigments was completed [19] by Australian Titan Products, Ltd., subsidiary of British Titan Products Co., Ltd., near Burnie, Tasmania, in 1949. Initial output of 5 tons daily (about 1,800 annually) was anticipated; this was expected to be increased by 1951 to 10 tons daily. Indian ilmenite was being used, but experiments with Australian concentrate were in progress. Titanium dioxide was produced [20] experimentally in 1949 from Australian rutile by Zircon Rutile, Ltd., at South Yarra, Victoria. Construction of a larger plant was under consideration. Australia has produced [21] experimental quantities of titanium metal. Research work has been carried out by the Australian Council for Scientific and Industrial Research. Technology of production of the metal in the form of rod, wire, and sheet has been developed by the Physical Metallurgy Section of the council in collaboration with the University of Melbourne.

Canada.—Progress in 1949 was reported in development of the Allard Lake property by the Quebec Iron & Titanium Corp.—owned two-thirds by the Kennecott Copper Corp. and one-third by the New Jersey Zinc Co. At the end of the year the 27-mile railway from Harve St. Pierre to the mine was more than half completed, and construction of harbor facilities was well under way, according to Kennecott's annual

[19] Queensland Government Mining Journal, Zircon-Rutile-Ilmenite: Vol. 50, No. 573, July 1949, pp. 375–376.
[20] Oil, Paint and Drug Reporter, Trade Briefs: Vol. 156, No. 4, July 25, 1949, p. 66.
[21] Metal Industry, Australia Titanium Supply: Vol. 75, No. 19, Nov. 4, 1949, p. 408.

report to stockholders. Construction of the wharf and smelter at Sorel, on the south bank of the St. Lawrence River, was in progress, as was construction of the power line from Three Rivers. If the present schedule is maintained in 1950, as anticipated, one furnace of the five now contemplated, should be in operation in 1951. The over-all expenditure to bring the property to the anticipated daily production of 1,500 tons of ilmenite, to yield 500 tons of iron and 700 tons of titanium dioxide, now is expected to be $30,000,000. The company's annual production target was 550,000 tons of ore, from which the furnaces at Sorel would yield 175,000 tons of high-grade iron and 250,000 tons of titanium oxide slag, averaging over 70 percent TiO_2.

Dominion Magnesium, Ltd., began production of titanium metal in September 1948 at its Government-built pilot plant at Haley, Ontario, using the Pidgeon-Rostrom process, claimed to be considerably cheaper than other processes. Ingots of 25 to 200 pounds of metal of 99.5–99.6 percent purity are being produced occasionally for Government experimental work.

Ceylon.—From time to time the reports of this series have indicated that consideration was being given to the production of ilmenite from extensive black beach sands in Ceylon. Several reports in 1949 indicated that the Government proposed erecting a milling plant; and one, at least, indicated [22] that a plant for the production of pigments was under consideration. Plans were for exploitation first of the sands at Pulmoddai in the Trincomalee district.

India.—Before World War II, India led all other countries by a substantial margin in the production of ilmenite. The disruption to international trade, caused by World War II, resulted in establishment of the United States as the leading world producer of this product. Concern has been expressed in India over the possible loss of the United States market as an outlet for Indian ilmenite exports, but the shipment of new peak quantities of these concentrates to the United States in 1949 showed that the fears were premature and perhaps entirely unwarranted.

United Kingdom.—Imports of titanium ores into the United Kingdom were reported as 75,693 long tons in 1949 compared with 57,247 in 1948 and 71,250 in 1947.

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[22] Mining Journal (London), Ceylon and India: Vol. 232, No. 5934, May 14, 1949, p. 351.

Tungsten

By Hubert W. Davis

GENERAL SUMMARY

A SUBSTANTIAL decline in the output of high-speed steels and of tungsten powder and much smaller exports of ferrotungsten in 1949 were largely responsible for a 44-percent drop in consumption of tungsten concentrates. Shipments of Class A (1.8 to 6 percent W) and Class B (19 to 22 percent W) high-speed steels declined 55 and 44 percent, respectively, from 1948, production of tungsten powder was about one-third less, and exports of ferrotungsten dropped 51 percent. To conform to the lessened demand, some domestic mines suspended operations, and production rates at most of the others were reduced. As a consequence, domestic output and shipments of tungsten concentrates (60 percent WO_3 basis) were 3,043 and 2,765 short tons, respectively, in 1949—decreases of 28 and 31 percent from 1948. California was again the premier tungsten-producing State, and North Carolina displaced Nevada as the second largest. The Tungsten Mining Corp. in North Carolina rose to first place among United States producers of tungsten concentrates in 1949. Despite the much smaller demand for tungsten concentrates in 1949, the price for domestic concentrates was virtually the same as in 1948.

Salient statistics of tungsten ores and concentrates in the United States, 1945–49, in pounds of contained tungsten

Year	Production	Shipments from mines	Imports for consumption	Consumption	Industry stocks at end of year		
					Producers	Consumers and dealers	Total
1945	5,388,639	5,266,818	4,773,861	14,146,000	557,042	3,784,429	4,341,471
1946	4,671,042	4,942,282	6,869,438	6,458,000	285,865	3,694,256	3,980,121
1947	3,026,470	2,944,622	6,018,005	7,812,000	368,316	3,343,392	3,711,708
1948	[1] 4,033,389	[1] 3,858,287	7,548,101	8,853,000	563,418	5,284,901	5,848,319
1949	2,896,084	2,681,506	6,274,102	4,958,000	827,045	4,229,444	5,056,489

[1] Revised figure.

Imports of tungsten ores and concentrates for consumption in the United States were also much smaller than in 1948; they were 6,592 short tons (60 percent WO_3 basis), a decline of 17 percent from 1948. Asia, chiefly China, supplied 89 percent of the total imports in 1949 and 9 percent more than in 1948. Imports from South America, however, were 77 percent smaller. Of the total imports, 3,562 tons (60 percent WO_3 basis) from China were duty-free for the United States Government. The quoted price on imported ores and concentrates was much lower in 1949 than in 1948.

Consumption of tungsten concentrates (60 percent WO_3 basis) in the United States was 5,210 short tons in 1949, compared with 9,300 tons in 1948. Usage of tungsten concentrates for conversion to ferrotungsten, for direct charge to the steel bath, and for the production of tungsten-metal powder and other tungsten products was much less than in 1948, but the decline was most pronounced for direct charge to the steel bath.

Industry stocks of tungsten concentrates (60 percent WO_3 basis) were 5,313 short tons on December 31, 1949, compared with 6,145 tons at the end of 1948.

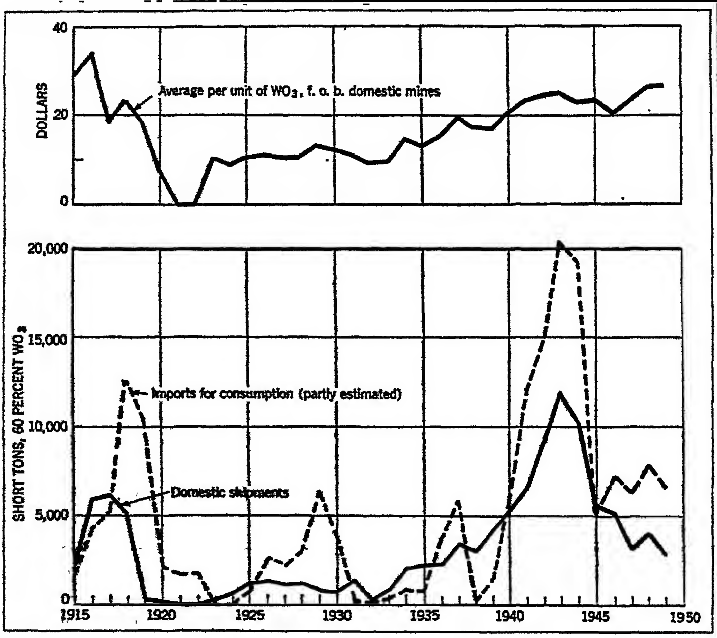

FIGURE 1.—Trends in domestic shipments, imports, and average price of tungsten ores and concentrates, 1915–49.

DOMESTIC PRODUCTION

The tungsten ore mined and milled in the United States, in general, contains 0.5 to 2.5 percent WO_3 and is beneficiated to a concentrate containing 60 percent or more WO_3. The leading tungsten producers and many small operators depend on ore carrying tungsten only as scheelite (calcium tungstate). Hübnerite (manganese tungstate), wolframite (iron-manganese tungstate), and ferberite (iron tungstate), in the order listed, contributed smaller quantities of the tungsten in domestic ore mined in 1949. Most of the concentrates are converted to ferrotungsten and tungsten powder. Some high-purity concentrates, however, are charged directly to the steel bath.

To conform to the lessened demand for tungsten in 1949, some mines suspended operations, and the production rates at most of the others were reduced. As a consequence, output of concentrates (60 percent WO_3 basis) declined to 3,043 short tons in 1949 compared with 4,238 tons (revised figure) in 1948. Production in 1949 was obtained from many widely scattered operations in nine States and Alaska, but three States—California, Nevada, and North Carolina—supplied 86 percent of the total; and seven operators—Bradley Mining Co., Climax Molybdenum Co., Nevada-Massachusetts Co., Nevada Scheelite, Inc., Surcease Mining Co., Tungsten Mining Corp., and United States Vanadium Corp.—produced 92 percent of the United States total. California was again the premier tungsten-producing State, and North Carolina displaced Nevada as the second largest. The Tungsten Mining Corp. in North Carolina ascended to first place among United States producers of tungsten concentrates in 1949.

Tungsten concentrates produced and shipped in the United States, 1948–49, by States

State	Production				Shipments from mines			
	1948		1949		1948		1949	
	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units
Alaska	1	85	(1)	15				
Arizona	23	1,388	(1)	22	23	1,388	(1)	22
California	1,779	106,765	1,083	64,980	1,767	106,006	952	57,135
Colorado	198	11,854	220	13,217	208	12,463	222	13,311
Idaho	2	117	187	11,239	86	5,201	66	3,951
Missouri	8	484			4	242	2	117
Montana	[2] 28	[2] 1,663	9	554	[2] 28	[2] 1,663	9	554
Nevada	1,254	75,245	598	35,855	949	56,929	740	44,405
North Carolina	942	56,522	942	56,484	965	57,924	770	46,216
Oregon			3	173			3	173
Utah	3	146	1	31	3	146	1	31
Total	[2] 4,238	[2] 254,269	3,043	182,570	[2] 4,033	[2] 241,962	2,765	165,915

[1] Less than one-half ton.
[2] Revised figure.

Tungsten concentrates shipped from mines in the United States, 1945–49

Year	Quantity		Reported value f. o. b. mines		
	Concentrates, 60 percent WO_3 (short tons)	Tungsten content (pounds)	Total	Average per unit of WO_3	Average per pound of tungsten
1945	5,534	5,266,818	$7,692,691	$23.17	$1.46
1946	5,193	4,942,283	6,283,413	20.17	1.27
1947	3,094	2,944,622	4,349,851	23.43	1.48
1948	[1] 4,033	[1] 3,838,287	[1] 6,355,386	26.27	1.66
1949	2,765	2,631,506	4,377,066	26.38	1.66

[1] Revised figure.

Tungsten ore and concentrates shipped from mines in the United States, by States, 1944–49, with shipments for maximum year and cumulative shipments in 1900–49, in short tons of 60 percent WO_3

State	Maximum shipments		Shipments by years							Total shipments, 1900–49	
	Year	Quantity	1944	1945	1946	1947	1948	1949 Quantity	1949 Percent of total	Quantity	Percent of total
Alaska	1916	47	19	------	19	13	------	------	------	177	0.14
Arizona	1936	489	29	97	20	13	23	(1)	(2)	3,913	3.11
California	1943	3,871	3,027	1,073	1,262	394	1,767	952	34.43	37,404	29.72
Colorado	1917	2,707	296	234	213	68	208	222	8.03	25,056	19.91
Connecticut	1916	3	------	------	------	------	------	------	------	11	.01
Idaho	1943	4,648	4,005	2,130	641	61	86	66	2.39	15,360	12.21
Missouri	1940	13	1	------	------	------	4	2	.07	37	.03
Montana	1946	84	25	(1)	84	4	[3] 28	9	.32	545	.43
Nevada	1942	3,052	2,665	1,857	2,617	2,002	949	740	26.76	37,443	29.75
New Mexico	1915	45	9	------	------	------	------	------	------	103	.08
North Carolina	1948	965	186	132	307	538	965	770	27.85	2,938	2.34
Oregon	1949	3	------	------	------	------	------	3	.11	3	(2)
South Dakota	1917	270	7	4	1	------	------	------	------	1,296	1.03
Texas	1946	1	------	------	1	------	------	------	------	1	(2)
Utah	1917	33	9	5	27	1	3	1	.04	239	.19
Washington	1938	303	5	2	1	------	------	------	------	1,326	1.05
Total	1943	11,945	10,283	5,534	5,193	3,094	[3] 4,033	2,765	100.00	125,852	100.00

[1] Less than one-half ton.
[2] Less than 0.01 percent.
[3] Revised figure.

Alaska.—J. H. Scott Co. produced (but did not ship) a small quantity of tungsten concentrate averaging about 50 percent WO_3 at the Riverside mine near Hyder, Alaska, in 1949.

Arizona. Small quantities of concentrates (10 and 12 units of WO_3, respectively) were produced and shipped from two properties in Arizona in 1949.

California.—California again was the premier tungsten-producing State; nevertheless, output was 39 percent less than in 1948. Production of concentrates was 952 short tons averaging 68.3 percent WO_3 in 1949, compared with 1,542 tons averaging 69.2 percent WO_3 in 1948. Shipments of tungsten concentrates totaled 839 short tons averaging 68.1 percent WO_3 in 1949, compared with 1,549 tons averaging 68.4 percent WO_3 in 1948. Although concentrates were produced at a number of widely scattered operations, five producers (Consolidated Tungsten, Fresno Mining Co., O. A. Kittle Mining & Exploration Co., Surcease Mining Co., and United States Vanadium Corp.) supplied 93 percent of the State total. The bulk of the remainder was contributed by Adams & Van Voorhis, Alpine Mining Co., California Tungsten Mines, Sheridan & Bennett, Sherman Peak Mining Co., Tulare County Tungsten Mines, and Tungstar Corp.

The Pine Creek mine and concentrator of United States Vanadium Corp. near Bishop were operated at greatly reduced rates in 1949; consequently, the quantities of ore mined and concentrates produced were 30 and 40 percent, respectively, less than in 1948. The laying of 36-inch-gage track in the 7,240-foot low-level adit was completed in 1949.

Surcease Mining Co. closed its Spud Patch placer operation at Atolia in June 1949 but continued production through lease arrangements at other properties in San Bernardino County. Chiefly as a result of discontinuing operation at the Spud Patch placer, the output of concentrate in 1949 was 43 percent smaller than in 1948.

The Harrel Hill mine in Tulare County, operated by Consolidated Tungsten, produced 21 percent more tungsten concentrate in 1949 than in 1948.

Output at the Round Valley mine in Inyo County, operated by the O. A. Kittle Mining & Exploration Co., was 5.3 times that in 1948. Operations were discontinued on December 31, 1949.

The Alpine mine in Alpine County, operated by Alpine Mining Co., the Strawberry mine in Madera County, operated by Fresno Mining Co., and the Big Jim mine in Tulare County, operated by Tulare County Tungsten Mines, operated at much lower rates in 1949 than in 1948. At the Strawberry mine an electric hoist was installed, and two Diester-type and one Wilfley-type tables and a 225-horsepower Diesel were added to the mill.

The Black Rock mine in Mono County, operated by Tungstar Corp., the Yaney mine in Inyo County, operated by Adams & Van Voorhis, a property in Tulare County, operated by California Tungsten Mines, and the Sherman Peak mine (also in Tulare County), operated by Sherman Peak Mining Co., produced small quantities of tungsten concentrates in 1949.

Colorado.—Production and shipments of tungsten concentrates (60 percent WO_3 basis) in Colorado were 220 and 222 short tons, respectively, in 1949 compared with 198 and 208 tons, respectively, in 1948.

The Climax Molybdenum Co., which began recovery of the very small tungsten content of its molybdenite ore at Climax, Lake County, in May 1948, was the chief producer of tungsten concentrates in Colorado in 1949; its output was 36 percent greater than in 1948.

Comparatively small quantities of tungsten concentrates were produced by leasers in Boulder County.

Idaho.—The Bradley Mining Co., operating the Ima mine in Lemhi County, Idaho, produced 158 short tons of hübnerite concentrate averaging 71 percent WO_3 in 1949. The new concentrator to serve the Ima mine [1] was completed and put into operation in January 1949; it replaced one destroyed by fire December 10, 1947.

Missouri.—A small quantity of tungsten concentrate was shipped from stock by the And-Mor Mining Co. in 1949.

Montana.—The H & H Mines, Inc., worked gravel containing scheelite and gold in lower Henderson Creek near Drummond, Granite County, Mont., in 1949; production of concentrate was 8 short tons averaging 67.91 percent WO_3 compared with 26 tons (revised figure) averaging 63.01 percent WO_3 in 1948.

Nevada.—Nevada dropped from second to third place as a tungsten-producing State in 1949. Production of concentrates was 483 short tons averaging 74 percent WO_3 in 1949 compared with 1,076 tons averaging 70 percent WO_3 in 1948. Shipments were 606 tons averag-

[1] Mecia, J. A., Ima Mine Resumes Operations: Min. Cong. Jour., vol. 35, No. 4, April 1949, pp. 88–92, 122.

ing 73 percent WO_3 in 1949 compared with 874 tons averaging 65 percent WO_3 in 1948.

The Nevada-Massachusetts Co. again was the largest producer of tungsten concentrates in Nevada in 1949, but because of suspension of operations from July 1 through the remainder of the year its output was 52 percent less than in 1948. Shipments of concentrate, however, were only 8 percent smaller.

Nevada Scheelite, Inc., operating a mine of the same name in Mineral County, again was the second-largest producer of tungsten concentrates in Nevada. However, the operating rate was reduced substantially on March 15 and, as a consequence, the output of concentrates in 1949 was about half that in 1948.

The chief smaller producers of concentrates in 1949 were the Cherry Creek Mining Co., operating the Cherry Creek mine in White Pine County; the Lincoln Mining Co., operating the Lincoln mine in Lincoln County; and Minerva Scheelite Mining Co., operating the Scheelite Chief mine in White Pine County.

North Carolina.—The Tungsten Mining Corp., operating the Hamme mine in Vance County, N. C., ascended to first place among United States producers of tungsten concentrates in 1949. Output was 921 short tons averaging 61.35 percent WO_3 in 1949 compared with 969 tons averaging 58.32 percent WO_3 in 1948. Shipments by the company were 783 tons averaging 59.03 percent WO_3 in 1949 compared with 986 tons averaging 58.65 percent in 1948. During 1949 the company did 5,983 feet of diamond drilling and 4,118 feet of development. Its new central shaft was sunk 570 feet. The 300- and 500-foot levels of the No. 4 shaft were connected with the Central shaft, which was also connected with the No. 2 shaft at the 300-foot level. The Sneed No. 1 ore body was opened and mined on the 200-foot level. Several small ore bodies were found, including one in the schist which heretofore had not been considered favorable for ore occurrences. An improvised leaching unit for treatment of concentrates was installed in the mill.

Oregon.—A small quantity of tungsten concentrate was produced from ore mined by L. A. Bratcher from a property in Jackson County, near Ashland, Oreg., in 1949. The ore was concentrated by the Tulare County Tungsten Mines at its mill near Lindsay, Calif.

Utah.—A small quantity (31 units of WO_3) was produced by the Star Dust Mines, Inc., operating the Star Dust Mines in Tooele County, near Gold Hill, Utah, in 1949.

CONSUMPTION

Consumption of tungsten concentrates (60 percent WO_3 basis) in the United States was 5,210 short tons in 1949 compared with 9,300 tons in 1948. Of the total consumed in 1949, 2,472 tons (47 percent of the total) were converted to ferrotungsten, the form in which most of the tungsten is introduced into steel. However, high-purity tungsten concentrates are charged directly to the steel bath; 838 tons (16 percent) were so used in 1949. Tungsten-metal powder and other tungsten products, chiefly the former, utilized 1,900 tons or 37 percent of the total concentrates consumed in 1949.

PRICES

Prices on imported tungsten concentrates were, in general, downward in 1949. According to the Engineering and Mining Journal, quotations on imported concentrates ranged from $25.25 to $18 a short-ton unit of WO_3, duty paid. On the other hand, domestic scheelite of good known analysis, in carlots, delivered, was quoted at $28.50 a unit throughout 1949. The use of high-purity scheelite for direct smelting has placed a premium on this type of concentrate. As reported to the Bureau of Mines, the average price for domestic concentrates shipped was $26.38 a short-ton unit of WO_3 in 1949.

FOREIGN TRADE [2]

Domestic production is inadequate for requirements, and the United States imports both tungsten concentrates and products, chiefly the former. General imports (receipts) of ores and concentrates into the United States totaled 7,357,299 pounds (tungsten content), equivalent to 7,731 short tons of 60 percent WO_3 in 1949, a 25-percent decline from 1948. This quantity represents the ores and concentrates received in the United States, irrespective of final disposition. Although ores and concentrates were received from 13 foreign countries in 1949, 4 countries—China (68 percent), Bolivia (14 percent), Thailand (8 percent), and Korea (4 percent)—supplied 94 percent of the total.

Imports of ores and concentrates for consumption in the United States were 6,274,102 pounds (tungsten content), equivalent to 6,592 short tons of 60 percent WO_3 in 1949, a 17-percent decline from 1948. Imports for consumption represent ores and concentrates on which the duty has been paid and which have thereby entered into the domestic commerce of the United States and concentrates which enter duty free for the United States Government. China (73 percent), Korea (8 percent), and Thailand (6 percent) supplied 87 percent of the total. Of the total imports, 3,562 tons (60 percent WO_3) from China were duty free for the United States Government.

In 1949, 434 short tons (60 percent WO_3) of ores and concentrates were withdrawn from warehouses for smelting, refining, and export (972 tons in 1948), and 939 tons (gross weight) were reexported (391 tons in 1948). Ores and concentrates withdrawn for smelting, refining, and export and for reexport are free of duty.

The duty on tungsten ores and concentrates is 38 cents a pound on the metallic tungsten contained therein. This is equivalent to $6.03 a short-ton unit.[3]

Exports of tungsten ores and concentrates from the United States were 102 short tons (gross weight) in 1949, compared with 415 tons in 1948. Of the 1949 exports, 55 tons went to Italy, 30 tons to United Kingdom, 17 tons to Germany, and 13 pounds to Canada.

Imports of tungsten metal were 13,455 pounds in 1949 (224 pounds in 1948). Imports of ferrotungsten, chiefly from Korea, were 61,993

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[2] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[3] A unit, as applied to tungsten ores, is 1 percent of a ton of contained tungsten trioxide (WO_3). Thus, a short-ton unit is 20 pounds of WO_3 or 15.86 pounds of tungsten (W).

Tungsten ores and concentrates imported into the United States, 1948–49, by countries

[U. S. Department of Commerce]

Country	General imports [1]		Imports for consumption [2]		
	Gross weight (pounds)	Tungsten content (pounds)	Gross weight (pounds)	Tungsten content (pounds)	Value
1948					
Argentina	16,174	8,261	16,174	8,261	$12,058
Australia	164,051	87,974	6,782	3,629	3,435
Belgian Congo	199,810	110,758	209,922	116,417	122,937
Bolivia	[3] 2,032,778	[3] 663,765	[3] 1,963,958	[3] 664,987	[3] 634,492
Brazil	1,546,394	[3] 856,834	1,517,649	847,557	912,723
British East Africa	20,539	11,337	20,539	11,337	14,824
Canada	583,195	337,878	631,030	363,391	432,182
Chile			76,796	40,641	39,041
China	9,186,480	[3] 4,893,328	6,964,372	3,699,850	3,827,676
French Indochina and French India	803,360	178,401			
Japan	55,115	[3] 28,845	135,662	71,095	68,311
Korea	3,598,789	1,723,275	1,813,771	980,765	947,062
Mexico	314,370	151,492	289,422	153,432	166,600
Peru			[3] 470	[3] 271	[3] 220
Portugal	24,125	10,207	25,873	12,240	8,807
Southern Rhodesia	77,840	31,136	25,406	12,728	12,795
Spain	503,416	261,791	580,466	181,617	207,617
Thailand	809,333	393,054	693,748	379,883	366,481
Total	19,935,769	[3] 9,748,336	14,972,040	7,548,101	7,777,261
1949					
Australia	113,120	64,480	138,547	77,893	103,130
Belgian Congo	172,092	94,647	172,115	94,684	90,238
Bolivia	2,945,972	1,044,982	372,118	210,743	206,687
Brazil	115,530	64,496	221,138	120,640	136,496
Burma	142,797	72,737	10,278	5,862	5,139
China	9,509,713	4,960,427	8,750,628	4,548,046	4,164,729
French Indochina and French India			607,781	152,371	148,807
Japan			342	186	65
Korea	634,530	322,555	888,706	497,441	475,222
Mexico	167,768	84,239	66,724	21,358	23,711
Netherlands	6,081	3,456	6,081	3,456	3,341
Peru	55,124	31,074	57,555	32,619	19,438
Portugal	340	154	308	176	154
Southern Rhodesia			85,653	1,542	1,815
Spain	72,245	41,591	231,336	123,473	122,012
Thailand	1,184,253	572,461	782,413	383,612	455,263
Total	15,119,565	7,357,299	12,391,723	6,274,102	5,956,247

[1] Comprises ores and concentrates received in the United States; part went into consumption during year, and remainder entered bonded warehouses.
[2] Comprises ores and concentrates withdrawn from bonded warehouses during year (irrespective of time of importation) and receipts during year for consumption.
[3] Revised figure.

pounds containing 45,295 pounds of tungsten in 1949 (none in 1948). There were no imports of tungstic acid, tungsten carbide, or combinations containing tungsten or tungsten carbide in 1948 or 1949.

Exports of ferrotungsten were 620,645 pounds (gross weight) in 1949 (1,255,435 pounds in 1948). Exports of tungsten metal, stellite, wire, shapes, and alloys other than ferrotungsten were 106,860 pounds in 1949 (181,956 pounds in 1948).

WORLD REVIEW

The accompanying tables show production of tungsten ores, by countries, from 1905 through 1948; figures before 1905 are not available. Despite the fact that production in China did not begin until 1914, it has been the premier tungsten-producing country and has

supplied 28 percent of the world total during the 44 years 1905–48. The United States has been the second-largest producing country, but it has contributed only 13 percent of the world total. Burma has ranked third as a tungsten-producing country and has accounted for nearly 13 percent of the world total. Thus, China, the United States, and Burma have furnished nearly 54 percent of the world total. Bolivia, Portugal, and Korea, in the order named, have been the largest of the other producing countries and, together, have supplied 22 percent of the world total.

World production of tungsten ores, by countries, 1905–48, in metric tons of concentrates containing 60 percent WO_3

[Figures for a few countries for certain years represent exports or shipments rather than production, and fiscal years rather than calendar years]

Year	North America					South America					
	Canada	Cuba	Mexico	United States	Total North America	Argentina	Bolivia	Brazil	Chile	Peru	Total South America
1905	-------	-------	-------	728	728	-------	68	-------	-------	-------	68
1906	-------	-------	-------	842	842	296	68	-------	-------	-------	364
1907	-------	-------	-------	1,488	1,488	460	454	-------	-------	-------	914
1908	-------	-------	-------	609	609	497	170	14	-------	-------	681
1909	-------	-------	-------	1,469	1,469	817	152	-------	-------	-------	969
1910	75	-------	-------	1,652	1,727	749	210	-------	-------	14	973
1911	-------	-------	-------	1,033	1,033	619	336	-------	-------	52	1,007
1912	15	-------	-------	1,207	1,222	637	496	-------	-------	219	1,352
1913	11	-------	-------	1,394	1,405	575	297	-------	-------	324	1,196
1914	-------	-------	-------	898	898	437	290	-------	-------	213	940
1915	-------	-------	140	2,116	2,256	169	859	-------	-------	413	1,441
1916	-------	-------	159	5,373	5,532	854	3,288	5	2	532	4,681
1917	-------	-------	308	5,574	5,882	1,085	4,215	-------	-------	427	5,727
1918	15	-------	239	4,591	4,845	614	3,703	-------	-------	256	4,573
1919	-------	-------	103	297	400	204	2,161	-------	-------	139	2,504
1920	-------	-------	82	196	278	182	766	-------	-------	77	1,025
1921	-------	-------	37	-------	37	52	174	-------	-------	2	228
1922	-------	-------	-------	-------	-------	125	9	-------	-------	-------	134
1923	-------	-------	-------	219	219	144	-------	-------	-------	-------	144
1924	-------	-------	-------	513	513	137	-------	-------	-------	-------	137
1925	-------	-------	-------	1,080	1,080	4	82	-------	-------	5	91
1926	-------	-------	-------	1,254	1,254	11	109	-------	-------	-------	120
1927	-------	-------	-------	1,056	1,056	10	79	-------	-------	-------	89
1928	-------	-------	-------	1,096	1,096	24	29	-------	-------	-------	53
1929	-------	-------	11	753	764	63	1,630	-------	-------	-------	1,693
1930	-------	-------	28	637	665	98	888	-------	-------	-------	986
1931	-------	-------	-------	1,274	1,274	20	410	-------	-------	-------	430
1932	-------	-------	-------	359	359	6	686	-------	-------	-------	692
1933	-------	-------	-------	812	812	-------	240	-------	-------	-------	240
1934	-------	-------	80	1,859	1,939	392	794	-------	-------	12	1,198
1935	-------	-------	54	2,173	2,227	579	1,423	-------	7	57	2,066
1936	-------	-------	57	2,370	2,427	702	1,741	-------	3	92	2,538
1937	-------	-------	33	3,175	3,208	866	1,802	6	18	78	2,770
1938	-------	-------	76	2,761	2,837	1,195	2,530	2	5	170	3,902
1939	4	-------	229	3,889	4,122	1,309	3,337	7	-------	170	4,823
1940	6	3	216	4,825	5,050	1,417	4,183	9	-------	290	5,899
1941	32	-------	191	5,957	6,180	1,720	4,353	35	1	337	6,446
1942	244	7	193	8,467	8,911	2,115	5,606	9	-------	510	8,240
1943	618	7	516	10,836	11,977	2,390	6,902	1,264	3	722	11,281
1944	214	-------	336	9,329	9,879	2,043	7,935	2,221	3	635	12,837
1945	-------	9	134	5,020	5,163	1,067	3,851	2,192	-------	523	7,633
1946	-------	-------	95	4,711	4,806	457	2,120	1,623	-------	510	4,710
1947	375	-------	97	2,807	3,279	33	2,635	1,329	-------	579	4,576
1948	791	-------	168	3,659	4,618	33	2,485	1,144	-------	353	4,015
Total	2,400	26	3,582	110,358	116,366	25,207	73,566	9,860	42	7,711	116,386

World production of tungsten ores, by countries, 1905–48, in metric tons of concentrates containing 60 percent WO_3—Continued

Figures for a few countries for certain years represent exports or shipments rather than production, and fiscal years rather than calendar years]

Year	Europe											
	Austria	Czechoslovakia	France	Germany	Italy	Norway	Portugal	Spain	Sweden	U.S.S.R.	United Kingdom	Total Europe
1905	59	------	25	38	33	------	290	375	------	------	175	995
1906	57	------	18	52	25	------	571	201	------	------	276	1,200
1907	45	------	61	62	16	------	637	275	------	------	327	1,423
1908	40	------	112	42	------	------	620	226	------	------	237	1,277
1909	39	------	50	96	------	------	552	129	------	------	382	1,248
1910	49	------	30	95	------	------	1,027	153	------	------	279	1,633
1911	45	------	171	81	------	------	978	96	------	------	270	1,641
1912	66	------	229	92	------	9	1,330	183	------	------	196	2,105
1913	52	------	160	96	------	3	1,126	169	------	------	197	1,803
1914	57	------	145	108	------	5	667	135	------	------	222	1,339
1915	14	------	126	193	------	------	953	189	------	------	360	1,835
1916	[1] 51	(1)	162	115	5	1	1,418	425	------	34	407	2,618
1917	[1] [2] 50	(1)	261	295	1	1	1,580	446	------	126	255	3,015
1918	[1] [2] 50	(1)	45	196	------	2	1,150	534	3	25	307	2,312
1919	------	70	70	145	------	------	706	302	30	5	177	1,505
1920	------	48	23	45	------	------	237	57	5	1	83	499
1921	------	35	------	27	7	------	306	25	------	------	81	481
1922	------	28	------	42	------	------	527	------	------	------	3	600
1923	------	28	------	40	1	------	289	9	------	------	2	369
1924	------	66	------	13	------	------	304	161	------	------	2	546
1925	------	60	------	161	------	------	207	26	------	9	1	464
1926	------	86	26	------	------	------	358	123	------	44	20	657
1927	------	78	8	------	------	------	174	164	------	42	12	478
1928	------	73	------	------	------	------	151	193	------	58	96	571
1929	------	75	1	------	------	------	358	257	------	(3)	27	718
1930	------	74	------	------	------	------	499	254	------	(3)	153	980
1931	------	17	------	5	------	------	274	135	------	(3)	121	552
1932	------	------	------	------	------	------	272	43	------	(3)	2	317
1933	------	------	------	------	------	------	358	46	------	(3)	12	416
1934	------	------	------	1	------	------	610	49	------	(3)	223	883
1935	------	------	------	------	------	------	1,140	------	------	(3)	256	1,396
1936	------	------	------	------	------	------	1,414	------	62	(3)	221	1,697
1937	------	------	------	------	3	3	2,069	250	127	(3)	148	2,600
1938	------	------	22	------	4	19	2,810	215	180	(3)	258	3,508
1939	------	------	284	------	2	31	3,851	368	158	[2] 300	188	5,182
1940	------	------	138	------	2	10	4,858	393	145	[2] 500	201	6,247
1941	------	------	120	------	1	8	5,834	415	228	[2] 500	127	7,233
1942	------	------	95	------	5	7	5,220	1,462	267	[2] 700	198	7,954
1943	------	------	126	------	2	------	7,477	3,902	290	[2] 900	237	12,934
1944	------	------	84	------	2	4	4,088	2,393	335	[2] 1,000	350	8,256
1945	------	------	185	------	6	5	------	283	413	[2] 1,300	120	2,312
1946	------	------	286	------	------	------	630	431	490	[2] 1,500	108	3,445
1947	------	------	391	------	------	------	3,149	461	322	[2] 1,500	68	5,891
1948	------	------	563	------	------	------	2,930	888	317	[2] 1,500	[2] 70	6,268
Total	[4] 674	[4] 738	4,017	2,040	115	108	63,999	16,841	3,372	[5] 10,044	7,455	109,403

See footnotes at end of table.

World production of tungsten ores, by countries, 1905–48, in metric tons of concentrates containing 60 percent WO_3—Continued

[Figures for a few countries for certain years represent exports or shipments rather than production, and fiscal years rather than calendar years]

Year	Africa									
	Belgian Congo	Egypt	French Morocco	Nigeria	Southern Rhodesia	South-West Africa	Tanganyika	Uganda	Union of South Africa	Total Africa
1905										
1906					8					8
1907					191					191
1908					36					36
1909					14					14
1910										
1911										
1912										
1913					5					5
1914										
1915					1					1
1916					2				2	4
1917					11				18	29
1918					37				37	74
1919				32	20				9	61
1920					17					17
1921					17					17
1922					44					44
1923										
1924					22					22
1925					22					22
1926										
1927					33					33
1928					15					15
1929					28					28
1930					38					38
1931					24				2	26
1932					14					14
1933					33	3				36
1934				5	117	18				140
1935				16	26	53	6		11	112
1936				11	88	46	2		30	177
1937		193		9	275	41	2	2	40	562
1938		24	7	49	329	48	5	2	127	591
1939			4	237	270	50		2	100	663
1940	63	15		131	246	24	2		105	586
1941	123	43			264	116	1		142	689
1942	315	17		100	504	122	2	7	400	1,467
1943	467	42		75	806	174	3	33	430	2,030
1944	433	16	3	30	757	118		95	660	2,112
1945	513			6	287	4		92	452	1,354
1946	397			5	53			102	144	701
1947	670			4	26	10		139	91	940
1948	236	15		4	80	12		126	151	624
Total	3,217	365	14	714	4,760	839	23	600	2,951	13,483

See footnotes at end of table.

World production of tungsten ores, by countries, 1905–48, in metric tons of concentrates containing 60 percent WO_3—Continued

Figures for a few countries for certain years represent exports or shipments rather than production, and fiscal years rather than calendar years]

Year	Asia									
	Burma	China	French Indo-china	India	Indo-nesia	Japan	Korea	Malaya	Thai-land	Total Asia
1905	--------	--------	--------	--------	--------	43	--------	--------	--------	43
1906	--------	--------	--------	--------	--------	43	--------	137	--------	180
1907	--------	--------	--------	--------	5	64	--------	81	9	159
1908	--------	--------	--------	--------	23	200	--------	75	--------	298
1909	--------	--------	--------	6	22	265	--------	90	--------	383
1910	369	--------	17	21	30	250	--------	95	--------	782
1911	1,015	--------	--------	--------	--------	260	--------	186	182	1,643
1912	1,901	--------	74	--------	26	204	--------	323	181	2,709
1913	1,572	--------	127	--------	6	257	--------	362	280	2,604
1914	2,166	18	162	--------	1	204	--------	460	273	3,284
1915	2,464	35	333	--------	6	389	67	488	432	4,214
1916	3,464	109	343	46	47	730	555	884	530	6,708
1917	4,226	1,361	433	68	8	763	919	1,171	726	9,675
1918	4,138	10,577	378	44	7	629	1,100	1,547	231	18,651
1919	3,623	2,654	284	1	--------	574	197	1,288	258	8,879
1920	2,983	4,712	284	--------	161	170	5	553	137	9,005
1921	673	2,657	452	--------	80	--------	--------	72	76	4,010
1922	1,038	3,873	112	--------	--------	--------	14	362	--------	5,399
1923	960	4,554	129	--------	10	--------	--------	434	--------	6,087
1924	814	3,398	150	--------	165	--------	--------	321	--------	4,848
1925	849	6,708	189	--------	27	--------	--------	425	127	8,325
1926	1,634	7,989	92	--------	9	19	--------	333	10	10,086
1927	1,277	5,666	213	--------	22	49	5	192	8	7,432
1928	843	8,283	175	--------	8	54	161	144	--------	9,668
1929	1,484	9,978	198	--------	10	61	15	513	62	12,321
1930	2,609	9,454	220	--------	15	81	13	1,232	7	13,721
1931	2,474	7,492	248	--------	1	56	17	703	12	11,003
1932	2,226	2,249	247	--------	--------	22	62	553	--------	5,359
1933	3,056	6,000	250	--------	--------	31	144	1,279	--------	10,760
1934	3,913	5,099	300	--------	1	70	399	2,011	36	11,829
1935	4,527	7,998	417	--------	1	96	949	2,035	82	16,105
1936	5,382	7,638	503	--------	1	61	1,849	2,037	82	17,553
1937	6,894	17,895	648	15	--------	206	1,590	1,356	221	28,825
1938	7,090	13,387	545	12	--------	300	2,625	1,082	251	25,292
1939	7,824	12,871	507	--------	2	299	3,969	587	378	26,437
1940	8,095	10,141	390	44	--------	479	4,525	522	400	24,596
1941	8,300	13,538	333	77	--------	601	4,650	56	961	28,516
1942	1,346	12,962	213	87	--------	817	6,062	61	1,653	23,201
1943	1,346	9,734	107	85	--------	733	6,932	146	1,738	20,821
1944	1,346	3,502	83	33	--------	575	8,402	217	1,135	15,293
1945	--------	2,929	8	22	--------	193	1,513	29	461	5,155
1946	--------	2,691	--------	3	--------	59	1,180	10	201	4,144
1947	1,045	6,900	--------	--------	--------	19	2,202	50	486	10,702
1948	1,824	12,200	--------	--------	--------	9	[3] 2,245	87	495	16,860
Total	106,880	237,252	9,164	564	694	9,935	52,366	24,589	12,121	453,565

See footnotes at end of table.

World production of tungsten ores, by countries, 1905–48, in metric tons of concentrates containing 60 percent WO_3—Continued

[Figures for a few countries for certain years represent exports or shipments rather than production, and fiscal years rather than calendar years]

Year	Oceania								Total world
	Australia						New Zealand	Total Oceania	
	New South Wales	Northern Territory	Queensland	Tasmania	Victoria	Western Australia			
1905	228	64	1,435	33	-	-	58	1,818	3,652
1906	245	208	785	20	-	1	110	1,369	3,963
1907	409	160	638	42	-	4	139	1,392	5,567
1908	244	36	468	5	3	-	79	835	3,736
1909	391	44	616	18	14	1	71	1,155	5,238
1910	375	71	1,039	68	28	2	169	1,752	6,867
1911	465	64	680	78	30	11	167	1,495	6,819
1912	270	40	856	79	12	-	164	1,421	8,809
1913	200	32	533	81	1	1	262	1,110	8,123
1914	221	45	401	56	-	1	242	966	7,427
1915	99	36	642	112	-	-	230	1,119	10,866
1916	313	137	519	126	17	5	306	1,423	20,966
1917	268	252	471	286	28	1	235	1,541	25,869
1918	279	280	357	440	5	6	170	1,537	31,992
1919	237	278	344	379	3	8	146	1,395	14,744
1920	39	245	119	209	9	3	47	671	11,495
1921	-	-	5	12	-	-	46	63	4,836
1922	-	19	4	21	-	-	-	44	6,221
1923	2	1	-	116	-	-	15	134	6,953
1924	10	-	1	64	-	-	18	93	6,159
1925	8	-	5	207	-	-	36	256	10,238
1926	-	-	1	98	-	-	15	114	12,231
1927	-	-	3	176	-	-	15	194	9,282
1928	-	-	29	209	-	-	6	244	11,647
1929	25	21	22	180	-	-	39	287	15,811
1930	17	67	24	133	-	-	21	262	16,652
1931	62	29	3	-	-	-	6	100	13,385
1932	27	15	8	-	-	-	9	59	6,800
1933	-	13	14	123	-	-	19	169	12,433
1934	59	89	41	230	-	-	39	458	16,447
1935	63	126	27	275	-	-	61	552	22,458
1936	18	141	22	245	-	-	49	475	24,867
1937	66	345	110	345	-	-	28	894	38,859
1938	124	480	193	400	-	-	54	1,251	37,381
1939	117	342	93	477	-	-	49	1,078	42,305
1940	76	314	129	607	-	-	88	1,214	43,592
1941	95	333	137	577	-	-	79	1,221	50,285
1942	52	159	217	475	-	-	73	976	50,749
1943	75	193	177	463	-	-	121	1,029	60,072
1944	53	102	229	300	-	-	159	843	49,220
1945	53	140	155	800	-	-	37	1,185	22,802
1946	42	74	75	850	-	-	30	1,071	18,877
1947	45	103	82	902	-	-	24	1,156	26,544
1948	28	72	96	1,031	-	-	28	1,255	33,640
Total	5,400	5,170	11,805	11,348	150	44	3,759	37,676	846,879

[1] Figures for Czechoslovakia included with Austria.
[2] Estimate.
[3] Data not available; no estimate included in total.
[4] Some production for Czechoslovakia included with Austria.
[5] Excludes production for 1929–38.

Accumulative world production of tungsten ores, by countries, 1905–48

Country	Metric tons, 60 percent WO_3	Percent of world total
North America:		
Canada	2,400	0.29
Cuba	26	(1)
Mexico	3,582	.42
United States	110,358	13.03
Total	116,366	13.74
South America:		
Argentina	25,207	2.98
Bolivia	73,566	8.69
Brazil	9,860	1.16
Chile	42	(1)
Peru	7,711	.91
Total	116,386	13.74
Europe:		
Austria Czechoslovakia	1,412	0.17
France	4,017	.47
Germany	2,040	.24
Italy	115	.01
Norway	108	.01
Portugal	63,999	7.56
Spain	16,841	1.99
Sweden	3,372	.40
U. S. S. R.	[2] 10,044	1.19
United Kingdom	7,455	.88
Total	[3] 109,403	12.92
Africa:		
Belgian Congo	3,217	0.38
Egypt	365	.04
French Morocco	14	(1)
Nigeria	714	.09
Southern Rhodesia	4,760	.56
South-West Africa	839	.10
Tanganyika	23	(1)
Uganda	600	.07
Union of South Africa	2,951	.35
Total	13,483	1.59
Asia:		
Burma	106,880	12.62
China	237,252	28.02
French Indochina	9,164	1.08
India	564	.07
Indonesia	694	.08
Japan	9,935	1.17
Korea	52,366	6.18
Malaya	24,589	2.91
Thailand	12,121	1.43
Total	453,565	53.56
Oceania:		
Australia	33,917	4.01
New Zealand	3,759	.44
Total	37,676	4.45
World total	[3] 846,879	100.00

[1] Less than 0.01 percent.
[2] Excludes production for 1929–38.
[3] Excludes production in U. S. S. R. for 1929–38.

Argentina.—Argentina formerly ranked as the second-largest producer of tungsten in South America. However, since 1943, output (60 percent WO_3 basis) has declined continuously from 2,390 metric tons to 457 tons in 1946, when production virtually ceased. The marked decline in tungsten operations has resulted chiefly from high cost of production.

Australia.—During the year ended October 31, 1949, the King Island Scheelite, N. L., milled 158,384 long tons of scheelite ore averaging 0.59 percent WO_3, which yielded 971 tons of concentrate averaging 67.51 percent WO_3. In the corresponding year 1948 it milled 142,641 tons of ore averaging 0.6 percent WO_3, which yielded 592 tons of concentrate. The increase in production of concentrate resulted largely to improved mill recovery, which was 72.2 percent in 1949. A low-grade concentrate is stored for future treatment. Company sales of concentrate were 862 tons in 1949 (525 tons in 1948). Ore reserves were estimated at 2,790,000 tons on October 31, 1949. The mine, which is on King Island, Tasmania, in Bass Strait, is worked by open-pit methods and is served by a treatment plant (capacity, 20,000 tons of ore monthly) comprising gravity units and a flotation section. Alterations were made in the mill, and classifiers in the ball-mill circuit were replaced by Hummer screens; as a result, there has been a reduction of slime in the ball mills and an improvement in the mill recovery.

Bolivia.—Bolivia continued to be the largest tungsten producer in South America. Output (as indicated by exports) was 2,543 metric tons (60 percent WO_3 basis) in 1949 compared with 2,485 tons in 1948.

Brazil.—Brazil continued to be the second-largest producer of tungsten in South America, but output declined for the fifth successive year. Output (as indicated by exports) of concentrates (65 percent WO_3) declined to 531 metric tons in 1949 from 1,056 tons in 1948.

Burma.—Production of wolframite and mixed tin and wolframite concentrates in Burma was 1,308 metric tons in 1949 compared with 2,500 tons in 1948.

Because of unsettled political conditions in Burma, full-scale production was not attained at the Mawchi mine in 1948 and 1949, when only 836 and 794 long tons, respectively, of tin-wolfram concentrates were produced. Operations at the Mawchi mine were suspended in June 1949.

China.—Production figures for China, the premier tungsten-producing country, are not available for 1949, but 5,212 short tons (60 percent WO_3 basis) were received in the United States.

France.—A promising deposit of wolframite was reported [4] to have been discovered near Confolens in the Department of Charente.

Korea.—Production of tungsten concentrates (60 percent WO_3 basis) in South Korea was 1,448 metric tons in 1949 compared with 1,245 tons in 1948. Plans have been made, it is reported,[5] to replace the existing recovery facilities at the Sangdong mine with modern equipment which would result in a substantial increase in production of tungsten concentrates.

Peru.—Production of tungsten concentrates in Peru declined substantially in 1949 and was the smallest since 1939. Output (60 percent WO_3 basis) was 250 metric tons in 1949 compared with 353 tons in 1948.

Portugal.—Portugal is the largest producer of tungsten in Europe, and the Panasqueira, Ribeira, and Borralha mines are the chief producers. Outputs of wolframite concentrates and mixed tin and wolframite concentrates were 2,604 metric tons in 1949 compared with 2,868 tons in 1948. Exports of wolframite concentrates, chiefly to England, were 3,590 metric tons in 1949 compared with 3,075 tons in 1948.

[4] Foreign Commerce Weekly, vol. 37, No. 13, Dec. 26, 1949, p. 29.
[5] Foreign Commerce Weekly, vol. 37, No. 12, Dec. 19, 1949, p. 29.

Uranium, Radium, and Thorium

By Jack W. Clark

GENERAL SUMMARY

AS THE second decade following discovery of uranium fission unfolded, it was evident that development of the socially beneficial aspects of atomic energy would continue to be secondary to military considerations. Announcement by President Truman in September of an atomic explosion in 1949 in the U. S. S. R. heightened international tensions through the realization that another major world power had probably begun production of atomic weapons. As an aftermath, the possibility of creating a superpowerful thermonuclear bomb was widely discussed. (See Lithium in the Minor Metals chapter of this volume.)

In the United States during 1949, notable gains were achieved in almost every phase of atomic energy activity, ranging from discovery of new uranium-ore deposits to production of fissionable materials, radioisotopes, and assembled weapons. Late in 1949 the Atomic Energy Commission announced that construction was underway on a "breeder" reactor designed to test the feasibility of creating, by a self-multiplying process, an appreciably larger quantity of fissionable plutonium than is presently obtainable from the type of piles operating at Hanford, Wash. In principle, such a "breeder" reactor will likewise determine whether or not thorium, an element more abundant than uranium, can be practicably transmuted into the fissionable uranium isotope, U–233. The results of this attempt to "breed" supplies of fissionable materials will help determine if nuclear fuels can be used within the foreseeable future as a competitive source of energy for nonmilitary power generation.

MINE AND MILL PRODUCTION

The carnotite-roscoelite deposits of southwestern Colorado, southeastern Utah, and northeastern Arizona have provided almost all of the domestic uranium ore produced to date. All mining operations are conducted by individuals or private companies. The AEC reported that during 1949 the number of operating mines increased 100 percent. Plants for processing the ores are operated by the Vanadium Corp. of America at Naturita and Durango, Colo.; the U. S. Vanadium Corp. at Rifle and Uravan, Colo.; and the Galigher Co. (for the AEC) at Monticello, Utah. The Monticello and Uravan facilities originally built for vanadium production, which have been inactive for several years, were redesigned and placed in operation in 1949, the former in September and the latter at the end of the year. A sixth plant at Hite, west of Blanding, Utah, which had been under construction in 1948–49 by the Vanadium Corp. of America, began operations in July 1949; the plant is designed to treat a copper-uranium ore peculiar to the area.

Exploratory diamond drilling on the Colorado Plateau by the AEC has been conducted since November 1947 through a contractual arrangement with the Geological Survey. From the inception of the program to the end of 1949 about 3,530 holes were drilled for a total of approximately 353,928 feet. Beginning in May 1949 the geological staff of the AEC began a similar program and had drilled a substantial footage by the year end. Before public land is drilled, it is withdrawn from private location by the Interior Department. Thus, by Public Land Order 565, dated March 4, 1949, an area of 32,000 acres was withdrawn for exploratory drilling in the vicinity of Blanding, Utah, and around the Monogram and Joe Dandy mines on the south flank of Paradox Valley, Colo. On the same date Public Land Order 494 restored to entry about 27,738 acres in the Beaver Mesa area near Gateway, Colo, which had previously been withdrawn for possible drilling.

Several significant discoveries of uranium ore were made in the United States during 1949. Early in the year secondary uranium minerals, chiefly autunite, were found extensively distributed in altered quartz monzonite, 7 miles northeast of Marysvale, Utah. Development was begun by the Bullion Monarch Mining Co. and the Vanadium Corp. of America and a stockpile of ore started. In July 1949 pitchblende was found in the Sunshine mine, Coeur d'Alene district, Idaho. Later, in August, a small uraninite-bearing vein was discovered in the Huron River gorge, Baraga County, in the Upper Peninsula of Michigan. The latter two finds apparently do not show commercial possibilities but are of importance in indicating the possible existence of two new uranium-bearing ore provinces. The Idaho Springs–Central City–Jamestown area of Colorado in the Front Range west of Denver is under intensive study by geologists of the Geological Survey and the AEC; the Quartz Hill mines near Central City reportedly produced 325 tons of pitchblende ore, containing about 50 tons U_3O_8, during the period 1872–1919.

Continued attention was paid by the AEC and the Geological Survey to study of low-grade uraniferous sediments known to occur over extensive areas in the United States. Most notable of these are the bituminous Chattanooga shales of Tennessee and Kentucky and the well-known, commercially worked phosphate deposits in Florida (Bone Valley formation) and in Idaho, Wyoming, Montana, and Utah (Phosphoria formation).

In a survey of domestic thorium resources, the monazite contents of placer deposits, principally in Idaho and California, were investigated by the Bureau of Mines, under contract to the AEC. Domestic output of monazite continued on a small scale in 1949 as a coproduct of the Florida titanium mining industry.

REFINERY AND REACTOR PRODUCTION

Uranium.—A plant for making brown oxide (UO_2) was placed in operation in 1949 and construction begun on a uranium metal works. Successful pilot-plant tests were made of newly devised processes for producing green salt (UF_4) and uranium hexafluoride; it is anticipated their eventual large-scale employment will cut production costs by about two-thirds and three-fifths, respectively. In mid-1949 the AEC reported the yield of U–235 from natural uranium had been increased and the cost of its extraction halved since 1947. U–235 is produced

at Oak Ridge, Tenn., in plants designated as K–25 and K–27. In August 1949 construction of a third unit, K–29, was begun; cost was estimated at $66,000,000. On December 2, 1949, the AEC announced that preliminary construction work for a fourth unit, K–31, to cost about $162,000,000, would begin almost immediately.

Plutonium.—A new reactor for production of plutonium was placed in operation at Hanford, Wash., in 1949 and a plutonium-metal fabrication plant completed. The AEC stated that, as a result of more efficient use of equipment, 40 percent more plutonium was being produced per dollar of operating cost than in 1947 and that the yield from a given quantity of feed material had increased.

Isotopes.—The Atomic Energy Commission reported significant improvements in isotope-production techniques, resulting in increased yields, greater purity of product, and higher specific activity.[1] Catalogs of isotopes available from the AEC were published.[2]

Isotopes shipped by the U. S. Atomic Energy Commission, by kinds, 1946–49, in number of shipments

Kind of isotope	1946 [1]	1947	1948	1949	Total
Iodine-131	68	495	978	1,537	3,078
Phosphorus-32	48	537	901	1,420	2,906
Carbon-14	47	108	124	192	471
Sodium-24	1	80	119	229	429
Sulfur-35	12	39	41	108	200
Calcium-45	5	42	33	68	148
Potassium-42	6	31	24	75	136
Gold-198 and -199	17	52	29	36	134
Iron-55 and -59	5	41	33	54	133
Cobalt-60	4	32	30	64	130
Strontium-89 and -90	3	9	18	19	49
Others	30	186	314	568	1,098
Total radioactive	246	1,652	2,644	4,370	8,912
Deuterium oxide (heavy water)		91	113	96	300
Deuterium (heavy hydrogen)		80	69	108	257
Boron-10 and -11		24	23	49	96
Oxygen-18		14	12	22	48
Electromagnetic concentrated			98	159	257
Total stable		209	315	434	958
Grand total isotopes	246	1,861	2,959	4,804	9,870

[1] Shipped by Manhattan District, Corps of Engineers, U. S. Army Service Forces.

Radium, Polonium, and Actinium.—International Rare Metals Refinery, Inc., Mount Kisco, N. Y., produces radium, radium–D, radon, and polonium and in 1949 announced recovery of actinium, a decay product of U–235. Vitro Manufacturing Co., Pittsburgh, Pa., reported shipments of radium bromide from stocks in 1949. Radium slimes from processing carnotite ore were sold in 1949 by S. W. Shattuck Chemical Co., Denver, Colo.

Thorium.—Compounds of thorium (principally nitrate and oxide) are prepared by Lindsay Light & Chemical Co., West Chicago, Ill., and Maywood Chemical Works, Maywood, N. J. The Norton Co., Worcester, Mass., produces electrically fused thoria and thoria refractory ware. Thorium metal is produced by the Bloomfield Lamp Division, Westinghouse Electric Corp., Bloomfield, N. J., and

[1] U. S. Atomic Energy Commission, Isotopes—a Three-Year Summary of the United States Distribution: August 1949, 201 pp.
[2] U. S. Atomic Energy Commission (Isotopes Division, Oak Ridge, Tenn.), Isotopes: Catalog and Price List 3, July 1949, 45 pp.; Supp. 2, December 1949, 2 pp.

has also been prepared in recent years by Metal Hydrides, Inc., Beverly, Mass.

Shipments of primary radium refined in the United States, 1941–43 (average) and 1944–49 [1]

Year	From domestic ores		From Canadian ores		Total	
	Milligrams	Estimated value	Milligrams	Estimated value	Milligrams	Estimated value
1941–43 (average)	2,042	$51,600			2,042	$51,600
1944	200	3,700	21,800	$403,300	22,000	407,000
1945	200	3,700	31,400	580,900	31,600	584,600
1946	200	3,700	17,400	321,900	17,600	325,600
1947	16,400	303,400			16,400	303,400
1948	4,219	77,980	3,510	63,200	7,729	141,180
1949	(2)	(2)	(2)	(2)	(2)	(2)

[1] Excludes confidential figures representing certain shipments in October 1943 to May 1944.
[2] Bureau of Mines not at liberty to publish figures.

CONSUMPTION AND USES

Weapons.—Development and stockpiling of atomic weapons were accelerated in 1949. Weapon production was placed on an industrial basis in contrast to former custom methods. The more effective type of weapons tested at Eniwetok Atoll, Marshall Islands, in 1948 were in production.

Industrial Power.—Attempts to evaluate the role, or cost, of nuclear energy in future power generation continue to lie in the realm of fancy until it has been demonstrated that the nuclear fuels plutonium and U–233 can be created economically, and in quantity, from the relatively abundant nonfissionable isotope of uranium, U–238, and the even more abundant element thorium (Th–232). In currently operating reactors using natural uranium (0.7 percent U–235, 99.3 percent U–238) some of the neutrons ejected by fission of U–235 are absorbed in nonfissionable U–238 to form plutonium; however, less plutonium is created than U–235 consumed. Under certain conditions, however, using enriched uranium (material in which the U–235 content is appreciably above that in natural uranium) in a pile, it is believed possible to create or to "breed" an appreciable excess of plutonium over the quantity of U–235 destroyed, thereby achieving a net gain in fissionable material. If such a multiplication process can be made to work with a high degree of efficiency, most of the common nonfissionable uranium isotope, U–238, could be converted to plutonium. Thorium (Th–232), unlike U–238, is not accompanied in nature by a spontaneously fissionable neutron-emitting isotope (U–235), so would require addition of such a substance to bring about its conversion to the fissionable element U–233. Once enough plutonium or U–233 has been created, each in turn is capable of performing the same function as U–235 in generating more nuclear fuel.

In view of the aforementioned considerations, great interest was aroused by the AEC announcement that construction of an experimental breeder reactor was to begin in December 1949 at its new 400,000-acre nuclear reactor testing station near Arco, Idaho. An important feature of the reactor will be the use of liquid metal as a heat-transfer medium. Total cost is estimated at $3,500,000. Construction is expected to be completed by the end of 1950.

Nuclear reactors now operating, under construction, or proposed for near-future construction in various countries

Country	Date of beginning operation	Fuel	Moderator	Coolant	Neutron velocity	Capacity kw.	Use
United States:							
Arco, Idaho	Construction begun December 1949.	Enriched uranium metal	(?)	Liquid metal	Fast	Very much higher than Los Alamos fast reactor.	Research in breeding fissionable material and in heat transfer.
Do	Proposed for construction in 1950.	Enriched uranium metal (?).	(?)	(?)	Fast (?)	(?)	Research in testing reactor construction materials.
Do	Proposed for construction in 1952.	Enriched uranium metal (?).	(?)	Liquid metal (?)	do	(?)	Research in power generation for ship propulsion.
Brookhaven, N. Y.	Under construction	Uranium metal	Graphite	Air	Slow	30,000	Research.
Chicago, Ill.	Dec. 2, 1942 (subsequently dismantled and rebuilt at a different site).	Uranium metal and oxide.	do	None	do	0.2	Research and radioisotope production.
Do	May 15, 1944	Uranium metal	Heavy water	Heavy water	do	300	Research.
Hanford, Wash.	4 piles; first 3 started operation 1944–45; fourth started July 1949.	do	Graphite	Water	do	Very much greater than 1,000.	Production of plutonium and radioisotopes.
Los Alamos, N. M.	1944	Enriched uranium salts	Water	do	Fast	10	Weapons research.
Do	(?)	Plutonium	(?)	(?)	do	(?)	Do.
Oak Ridge, Tenn.	Nov. 4, 1943	Uranium metal	Graphite	Air	Slow	2,000	Research and radioisotope production.
West Milton, N. Y.	Proposed for construction in 1950.	Enriched uranium metal (?).	(?)	Liquid metal	Intermediate	(?)	Research in breeding fissionable material and in power production.
Canada:							
Chalk River, Ont.	Sept. 5, 1945	Uranium metal	Heavy water	Heavy water	Slow	10,000	Research and radioisotope production.
Do	Proposed for near future construction.	(?)	do	(?)	(?)	(?)	(?).
France: Chatillon	Dec. 15, 1948	Uranium oxide	do	None	Slow	Few watts	Research.
Netherlands	Proposed	(?)	(?)	(?)	(?)	(?)	Power production.
Norway: Kjeller	Under construction	Uranium metal	Heavy water	(?)	Slow	100	Research and radioisotope production.
U. S. S. R. (?)	Later than 1945 (?)	Uranium metal (?)	Graphite (?)	Water (?)	Slow (?)	Large (?)	Production of plutonium and radioisotopes (?).
United Kingdom:							
Harwell	August 1947	Uranium metal	Graphite	Air	Slow	100	Research and radioisotope production.
Do	July 3, 1948	do	do	do	do	6,000	Do.
Sellafield	Construction reported suspended in 1949.	Uranium metal (?)	Graphite (?)	(?)	Slow (?)	Large (?)	Production of plutonium and radioisotopes.

A materials-testing reactor was also expected to be under construction at the Arco site early in 1950. Designed to operate at very high neutron flux density, the reactor will be used primarily to study the effect of neutron bombardment on materials that might be considered for use in constructing power-producing reactors of the future. Cost of the reactor was estimated at $25,000,000.

A third reactor to be built at Arco, Idaho, is a model of a type suitable for power generation for propulsion of ships, particularly naval vessels. It is anticipated that construction will be underway by 1952. The cost of the reactor is expected to amount to $25,000,000 or, perhaps, substantially more, depending upon difficulties encountered.

It was planned to begin assembling a fourth reactor during 1950 at West Milton, near Schenectady, N. Y. The unit would utilize neutrons in the intermediate energy range with the joint objectives of producing useful power and of breeding additional fissionable material. Heat energy would be removed with liquid metal. It was estimated that this reactor, the first to be designed to utilize intermediate-energy neutrons, would cost between $25,000,000 and $40,000,000.

Radiography.—The AEC in reporting on radioisotopes indicated that uses in medical research continued to be predominant over other fields.[3] Publications were issued outlining industrial and other uses.[4] Radium is used principally for treatment of tumors, as an energy source in luminous paints, and for industrial radiography.

Isotopes shipped by the U. S. Atomic Energy Commission, by uses, 1946–49, in number of shipments

Use	1946[1]	1947		1948		1949		Total		
	Radioactive	Radioactive	Stable	Radioactive	Stable	Radioactive	Stable	Radioactive	Stable	Grand total
Medical therapy	88	716		1,142		2,037		3,983		3,983
Animal physiology	78	508	35	777	35	1,028	33	2,391	103	2,494
Physics	17	134	104	202	205	315	305	668	614	1,282
Chemistry	27	138	57	225	50	228	79	618	186	804
Plant physiology	16	62	5	116	6	241	5	435	16	451
Industrial research	14	51	7	85	16	176	4	326	27	353
Bacteriology	4	33	1	53	3	83	2	173	6	179
Metallurgy	2	10		11		(2)	(2)	23		23
Other				33		262	6	295	6	301
Total	246	1,652	209	2,644	315	4,379	434	8,912	958	9,870

[1] Shipped by Manhattan District, Corps of Engineers, U. S. Army Service Forces. No stable isotopes shipped in 1946.
[2] Possibly included in "Other".

PRICES

Uranium Ore.—Early in 1949 the AEC issued a revised price schedule for the purchase of Colorado Plateau carnotite-roscoelite ores. Principal changes included a rise in the base price per pound of U_3O_8 contained in ores assaying 0.10–0.19 percent U_3O_8, payment of a development allowance on ores in the 0.10–0.14 percent U_3O_8 range, and incorporation of the old "facilities allowance" (see table

[3] U. S. Atomic Energy Commission, Atomic Energy and the Life Sciences: July 1949, pp. 75-109.
Work cited in footnote 1, pp. 75-125.
Work cited in footnote 2, Suppl. 1, September 1949, pp. 1-4.
[4] Arthur D. Little, Inc., Industrial Uses of Radioactive Materials: Cambridge, Mass., March 1949, 13 pp.
Keller Corp., Radioisotopes, A Survey: New York, N. Y., Jan. 1, 1950, 26 pp.

Consumption of uranium and thorium compounds for nonenergy purposes in the United States, 1945–49, in pounds of contained U_3O_8 and ThO_2

[U. S. Atomic Energy Commission]

Industry	1945	1946	1947	1948	1949
URANIUM (U_3O_8 EQUIVALENT)					
Chemical (including catalytic)	[1] 3,800	2,500	2,400	1,993	2,426
Ceramic (including glass)	150	1,000	825	385	270
Photographic	(1)	360		225	
Electrical	1,000	300	150	200	103
Total U_3O_8	4,950	4,160	3,375	2,803	2,799
THORIUM (ThO_2 EQUIVALENT)					
Gas-mantle manufacture	(2)	(2)	26,658	36,697	44,621
Refractories and polishing compounds	(2)	(2)	3,110	1,634	1,847
Chemical and medical	(2)	(2)	1,176	1,767	596
Electrical	(2)	(2)	1,283	427	237
Total ThO_2	(2)	(2)	32,227	40,525	47,301

[1] Photographic included with chemical.
[2] Figure not available.

in Minerals Yearbook, 1948, p. 1269) into the base price previously posted for ores containing 0.20 percent U_3O_8 or better.[5] The new schedule was to be in effect for the period February 1, 1949, through June 30, 1954.

Payment per pound of U_3O_8 under the revised price scale is stipulated as follows:

Percent U_3O_8	Price per pound U_3O_8	Percent U_3O_8	Price per pound U_3O_8
0.10	$0.50	0.16	$1.60
.11	.70	.17	1.70
.12	.90	.18	1.80
.13	1.10	.19	1.90
.14	1.30	.20	2.00
.15	1.50		

A minimum U_3O_8 content of 0.10 percent is specified. Premium payments will be made on uranium at 25 cents per pound U_3O_8 in excess of 4 pounds of contained U_3O_8 per short ton of ore and an additional premium of 25 cents per pound for each pound over 10 pounds per ton. A development allowance of 50 cents per pound contained U_3O_8 will be paid for ores assaying 0.10 percent U_3O_8 or more. Vanadium will be paid for at 31 cents per pound of contained V_2O_5, but payment will not be made for V_2O_5 present in excess of 10 pounds for each pound of contained U_3O_8, except at buyer's option through special written agreement with individual producers. Ores must not contain more than 3 parts lime ($CaCO_3$) to 1 part V_2O_5 and, in any case, lime must not exceed 6 percent; similarly, ores containing other undesirable impurities are unacceptable. A haulage allowance of 6 cents per ton-mile will be paid up to a maximum of 100 miles, for ore bought by the AEC and delivered to its purchasing depot.

Substantial tonnages of high-lime (over 6 percent $CaCO_3$) carnotite-roscoelite ore, unsalable under the aforementioned revised price

[5] U. S. Atomic Energy Commission, Guaranteed Minimum Price for Uranium-Bearing Carnotite-Type or Roscoelite-Type Ores of the Colorado Plateau Effective Feb. 1, 1949, through June 30, 1954: Domestic Uranium Program, Circ. 5, Feb. 7, 1949, 5 pp.

schedule, became marketable in July 1949 upon announcement by the AEC that special contracts would be drawn up for their purchase and delivery to the Monticello, Utah, plant. Terms of purchase will follow the pattern previously outlined for low-lime ore; but, because of the untoward effect of excessive lime upon vanadium recovery, appropriate deductions in price will be made to compensate. At the time the plan to purchase high-lime ores was announced, it was also reported that a suitable process for their treatment had been devised and would eventually be incorporated into the Monticello mill circuit as soon as enough ore had been accumulated to justify its installation.

The previously guaranteed minimum price of $3.50 per pound of U_3O_8 contained in ores other than the carnotite-roscoelite type[6] continued in effect during 1949. This price applies to ore assaying not less than 10 percent U_3O_8, 10 short tons minimum, f. o. b. designated shipping point. Higher prices may be paid by the AEC for guaranteed delivery of lots of ore or concentrates substantially exceeding 10 tons or under other conditions involving special refining, milling, and shipping costs.

Uranium.—During 1949 the AEC reported that 200 pounds of high-purity uranium metal would be made available for nonenergy use from the Mallinckrodt Chemical Co., St. Louis, Mo., at a price of about $50 per pound.

Radium.—A significant quantity of radium bromide was sold during 1949 at approximately $19 per milligram.

Isotopes.—In December 1949 the Isotopes Division of the AEC announced drastic reductions in the prices of certain fission-product isotopes when purchased in quantities exceeding 100 millicuries.[7]

Thorium.—Average prices in 1949 for thorium nitrate and oxide were reported by a large producer, respectively, as $2 per pound in 1,000-pound lots and $5 per pound in 10-pound lots. Electrically fused oxide was sold for $20 to $35 per pound, price varying with grain size and processing required. Thorium-metal powder in 1949, per gram, in lots of over 200 grams, was priced at 25 cents. (See Minor Nonmetals chapter, this volume, for monazite prices.)

FOREIGN TRADE[8]

The AEC announced that action had been taken in 1949 to assure a continuing supply of raw materials from other countries. A large proportion of the uranium used by the AEC is obtained from the Belgian Congo and Canada. Import and export data on uranium and thorium ores, concentrates, metal, alloys, and compounds are not disclosed. Total exports of radioisotopes reported by the AEC to the end of 1949 reached 700 shipments (20 in 1947, 335 in 1948, and 345 in 1949).

WORLD REVIEW

On September 23, 1949, President Truman announced publicly, "We have evidence that within recent weeks an atomic explosion occurred within the U. S. S. R." Subsequently, on October 24, during the cornerstone laying of the Secretariat Building of the permanent

[6] U. S. Atomic Energy Commission Regulations, part 60, Domestic Uranium Program, Circ. 1, Ten-Year Guaranteed Minimum Price, Apr. 9, 1948.
[7] Work cited in footnote 2.
[8] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price and E. D. Page of the Bureau of Mines, from records of the U. S. Department of Commerce.

Radium salts imported for consumption and exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Imports				Exports		
	Radium salts			Radioactive substitutes (value)	Radium salts		
	Grams	Value: Total	Value: Average per gram		Grams	Value: Total	Value: Average per gram
1945	67.342	$991,979	$14,700	$122,178	10.774	$229,632	$21,300
1946	[1] 16.596	[1] 325,922	[1] 19,600		(2)	(2)	(2)
1947	76.681	1,504,814	19,600		(2)	(2)	(2)
1948	[1] 77.018	1,385,337	[1] 17,900	6,273	(2)	(2)	(2)
1949	98.032	1,719,656	17,500	370	(2)	(2)	(2)

[1] Revised figure.
[2] Not separately classified.

United Nations headquarters in New York, the President reaffirmed the stand of the United States with respect to international control of atomic energy, stating,

> Ever since the first atomic weapon was developed, a major objective of United States policy has been a system of * * * control * * * that would assure effective prohibition of atomic weapons and at the same time would promote the peaceful use of atomic energy by all nations. * * * We support this plan (the Majority Plan for international control, approved by members of the Security Council excepting the U. S. S. R. and satellite countries) and will continue to support it unless or until a better and more effective plan is put forward.

In the latter part of 1949, representatives of the United States, Canada, and the United Kingdom met in London, England, to discuss problems relating to location, mining, and processing of radioactive ores and matters pertaining to reactor safeguards. Other discussions were held at Chalk River, Ontario, dealing with document declassification, radiation tolerance, and the design and performance of radiation detection and measuring instruments.

WESTERN HEMISPHERE

Brazil.—Extensive deposits of rich monazite sands occur along the beaches and inland from the coast of the States of Rio de Janeiro, Espirito Santo, and Baia. Monazite reserves of the principal deposits have been estimated at about 150,000 tons.[9] Exports of monazite concentrates from 1890–1949 have totaled almost 75,000 metric tons. The thorium content of Brazilian monazite averages about 6 percent ThO_2. Strong sentiment was rising that favored imposition of an embargo on monazite exports, with the twofold objective of conserving thorium resources for possible atomic energy use and of establishing a domestic rare-earth chemical industry.

Canada.—Essentially all Canadian uranium ore production has come from the mine of the Crown company, Eldorado Mining & Refining (1944), Ltd., at Great Bear Lake, N. W. T. The company

[9] Leonardos, Othon Henry, Devemos industrializar no Brasil os minerios de metais raros: Mineração e Metalurgia, vol. 14, No. 83, January–February 1950, pp. 137–138.

reported that underground exploratory diamond drilling and development footage at Great Bear Lake in 1949 amounted to 14,590 and 10,600 feet, respectively. Estimated ore reserves were said to be improved over the same period in 1948. Net profit for Eldorado Mining & Refining (1944), Ltd., was C$2,199,590 in 1949 compared to C$1,335,399 for 1948.

Extensive underground development work was done in 1949 on numerous properties showing commercial promise in the Goldfields area of Saskatchewan on the north shore of Lake Athabaska; the various deposits were described.[10] Exploration was active in 1949 at Contact Lake and in the Marian River-Hottah Lake regions, both south of Great Bear Lake; at Black Lake, 110 miles east of Goldfields; in British Columbia at the Victoria property near Hazelton and the Gem property in the Bridge River district; and in Ontario over an area bounded roughly by Sault Ste. Marie on the south, Agawa to the north, Lake Superior on the west, and the Mississagi River to the east. In the latter area exceptionally rich finds of pitchblende were found on the properties of Labine-McCarthy Uranium Mines, Ltd., and Ranwick Uranium Mines, Ltd., about 55 miles north of Sault Ste. Marie.

The Atomic Energy Control Board reported expenditures for the fiscal year 1948–49 (to March 31) on the Chalk River Project of C$6,476,714. The number of shipments of radioisotopes for the same period totaled 150. In a report dated Dec. 8, 1949, the Special Committee of the House of Commons on the Operations of the Atomic Energy Control Board recommended that an estimated C$40,000,000 be spent for a second heavy-water reactor, new housing and social facilities at Chalk River, Ontario, and research grants to Canadian universities.

The Government-guaranteed minimum price of $2.75 per pound of contained U_3O_8 in ore or concentrates, established in 1948, is for material containing a minimum of 10 percent U_3O_8, f. o. b. railhead, and is guaranteed for 5 years. Consideration is given to other values in the ore. In special circumstances higher prices may be paid or lower-grade ore purchased.

EUROPE

Germany.—The Soviet-owned Wismut A. G. controls all uranium (pitchblende) production from mines in the Erzgebirge region of eastern Germany. Work is said to be centered at Aue, Saxony.

U. S. S. R.—The development by the Soviets of an atomic bomb in 1949, as implied by the announcement of President Truman to the American people in September, indicated that a major industrial establishment devoted to nuclear energy had been realized in the U. S. S. R. Because of the drastic measures being employed by the Soviet authorities in developing the pitchblende veins of their zone of occupation in Germany and of the Jachymov region of Czechoslovakia, it is believed that these deposits may be their principal source of high-grade ore. Uranium may also be obtained by the U. S. S. R. from ores in Bulgaria and from the uraniferous black marine shales of Esthonia which extend into the Leningrad area of Russia. Mona-

[10] Christie, A. M., and Kesten, S. N., Pitchblende Occurrences of the Goldfields Area, Saskatchewan: Canadian Min. and Metal. Bull., vol. 42, No. 452, December 1949, pp. 643–650.

zite occurs widely in the Soviet Union, particularly in the alluvial gravels of Siberian rivers, such as the Yenisei.

D. B. Shimkin, Russian Research Center, Harvard University, reviewed Russian accounts of uranium ore deposits occurring within the confines of the Soviet Union [11] as follows:

> Russian research on radioactive minerals began in 1900–1903 * * * in the Fergana Valley (40° to 41° N., 70° to 73° E.) of Russian Central Asia. Beginning in 1909 the Imperial Academy of Sciences initiated more ambitious investigations. All previously gathered information was sifted carefully so that field work in 1911–1913 could be concentrated on the most promising localities: The Fergana Valley, Siberia, the Caucasus, Transcaucasus, and Urals. By 1914, indications from the Caucasus and Transcaucasus had become negative. In the Urals no indication of deposits of sufficient size for commercial exploitation could be found. Two areas appeared promising. One was Tyuya Muyun (40°21′ N., 72°0′ E.) in the Fergana Valley, with deposits of tyuyamunite, Ca $(UO_2)_2 \cdot V_2O_5 \cdot 6\ H_2O$, closely comparable to the carnotite of the American southwest. The other was the northwest slopes of the Khamar-Daban Range (51° to 52° N., 103° to 106° E.), especially near Slyudyanka (51°40′ N., 103°35′ E.) and the Trans-Siberian railroad between Baikal and Kultuk immediately across Lake Baikal, characterized by sites rich in mendelyeevite, with the probable composition, $2\ CaO \cdot 2(Ti, U)\ O_2 \cdot (Nb, Ta)_2O_5$ * * * .
>
> In 1914, a three-year program of research was authorized for the Academy of Sciences. The largest sums were to be devoted to expeditions in the Baikal area and the Fergana Valley, with lesser amounts going for investigations of the placer monazite deposits of the Transbaikal and for various minor projects. While World War I prevented full accomplishment of the program of the Academy of Sciences, enough was done to establish that only the Fergana Valley and the Baikal area had possibilities of commercial development. By 1918, the new Soviet Government began pressing for the resumption of laboratory and field investigations of radioactive minerals; on January 1, 1922, scattered radiological facilities in the USSR were combined in the Governmental Radium Institute of the Academy of Sciences * * *.
>
> This new institute concentrated its efforts on the site of Tyuya Muyun. An important reason for this decision was the fact that small-scale commercial operations had been begun there in 1908. Between 1908 and 1913 the Fergana Co. had mined 2,088,000 pounds of ore, 1,512,000 pounds of which had been sent to its plant in Leningrad for refining. * * * the ore contained, on the average, 2.36 percent V, 0.97 percent U_3O_8, and 3.73 percent Cu. Scientific study of Tyuya Muyun and the surrounding area * * * was pressed throughout the decade 1924–34 * * *.
>
> The Tyuya Muyun deposit is a vein field in * * * limestone * * * associated with extensive karst channels and caves. The vein field consists of at least five (1933) barite-ore veins bearing uranium, vanadium, and copper minerals and of over 30 pure barite veins. The productive veins are near the center of the deposit * * *. The barite veins extend up to 1,500 meters from the center; the maximum depth of the main vein may reach 500 meters.
>
> The ore bodies within the productive veins vary in thickness from 1.5 meters to a few centimeters, and correspondingly in length. Run-of-the-mine ore averages 1.5 percent U_3O_8, with a range of 0.6 to 4 percent, the higher values being found in the lower horizons. However, the uranium oxide content of the amorphous, brown, cupro-uranium carbonate lenses associated with the karst stalagmitic core runs from 26.12 to 50.25 percent. Also noteworthy are the uranium-free radiobarites—(Ba, Ra) SO_4—and radiocarbonates—$RaCO_3$—established in relatively high concentrations at both lower and upper horizons of the deposit. The irregularity of the Tyuya Muyun deposit has made impossible the estimation of reserves; the mine produced 534 metric tons of hand-sorted ore in 1925–26. By 1936, * * * the quantity of radium extracted from the Tyuya Muyun ores and from radioactive waters near Ukhta (approximately 63°35′ N., 53°40′ E.) was enough to meet the needs of the Soviet Union.
>
> Explorations in other parts of the Fergana Valley have also been undertaken In 1928, numerous indications of intense radioactivity were discovered in the western part of the Valley, but no uranium deposits. In 1923, * * * an account (was published) of the discovery of a uranium deposit at Uigar-sai or Atbash (41°2′ N., 71°12′ E.) on the northern side of the Fergana Valley. Geologically, the site was said to be closely similar to carnotite deposits in Colorado

[11] Shimkin, D. B., Uranium Deposits in the U. S. S. R.: Science, vol. 109, No. 2821, Jan. 21, 1949, pp 58–60.

and Utah. It is characterized by young, stream-deposited lenses of urano-vanadium ores, some of considerable size and richness. In terms of its high percentage of content, dimensions of individual ore bodies, and probable reserves the urano-vanadium deposit discovered at Uigar-sai does not yield to many carnotite sites in the U. S. A. The deposit is found under very favorable economic conditions, being situated at an automobile road; it is to undergo survey in 1939. * * * In the Tian Shan Range (are) other newly discovered deposits at Taboshar (40°37′ N., 69°39′ E.) and Maili su (41°18′ N., 72°27′ E.). In the first of these * * * uranium pitch (pitchblende (?)) is associated with bismuth glitter, wolframite, arsenopyrite, and sulfide polymetallic (lead, zinc) deposits. * * * the indicated uranium content of the ore is * * * of the order of 0.12–0.2 percent * * *. In the second site, infiltrations of urano-vanadium compounds are associated with tertiary limestones. Neither site was being commercially exploited in 1940.

In evaluating the significance of the Central Asiatic sites, it should be noted that, according to the Soviet prospecting plan for 1940, search for uranium and radium was to be concentrated in that area.

Two other recent finds of uranium-vanadium ores in Central Asia may be mentioned. In 1937, * * * an account (was published) of the deposit at Agalyk (39° 32′ N., 66° 52′ E.); * * * tyuyamunite was the most frequently occurring ore * * *. In 1940–41, the presence of uranium was established in a vanadium site in the northwestern tip of the Karatau Range (44° 30′ N., 67°30′E.). It represents a sedimentary deposit with subsequent metamorphism which has created a reiterated interbedding of thin bands of vanadium ores (with uranium-mineral accumulations) with flint bands. The total amount of uranium in the ore body (which extends for 25–30 km., with a thickness of 10–14 m.) is great; * * * the preliminary surveys of 1942 should be followed by more extensive explorations of the area.

In the area of the Khamar-Daban Range, serious investigations have been undertaken only at Slyudyanka, which is significant as a phlogopite mica deposit. * * * the presence of mendelyeevite (was) established * * * uranium oxide content in all samples ranged from 19.70 to 28.90 percent.

From an economic standpoint the results at Slyudyanka seem to be negative for mendelyeevite was found only in the pegmatite veins of two parts of the deposit, in which it appears generally to play a subordinate role. * * *

Despite the seemingly negative picture at Slyudyanka, the widespread development of formations, closely resembling the productive sector of this deposit, from the Sayan Range (approx. 50° N., 100° E.) northeastward to the Aldan gold fields (approx. 58° N., 125° E.) cannot be ignored. A genetic relationship may exist between niobium–tantalum–uranium ores and phlogopite mica; * * *. Thus the discovery of three major phlogopite-mica deposits in the Aldan gold field area * * * heightens the probability of corresponding finds to an unknown degree.

* * * Great importance (was attached) to further study of the Ukrainian magnetite-orthite pegmatites, particularly in the areas of Novograd Volynskii (50° 30′ N., 27° 40′ E.) and Berdyansk-Mariupol (46° 40′ N., 36° 50′ E.) to 47° N., 37° 30′ E.). * * * the likelihood of large, unexpected discoveries of Nb, Ta, U, Ti, and other minerals in these areas (was emphasized).

* * * Soviet discoveries of uranium in Central Asia within the last decade * * * appear to provide a possible basis for the development of atomic power in that area. * * * All of the Central Asiatic deposits are found within a radius of 250 miles from the important hydroelectric plants of the Tashkent area, which produced 882,000,000 kilowatt-hours of energy in 1943. Labor, transportation, and climatic conditions are also favorable here.

United Kingdom.—Construction of Britain's third nuclear reactor, on a site at Sellafield, Cumberland, was suspended in December 1949 by the Ministry of Supply following the October announcement of Prime Minister Atlee that Government departments were to cut expenditures. Plutonium was made for the first time in the United Kingdom, early in 1949, being created in "Gleep" (graphite low-energy experimental pile) the smaller of the two piles operating at Harwell, Berkshire.

Radioisotopes for medical and industrial use are being produced in both piles in considerable quantity; production from the larger reactor, "Bepo" (British experimental pile), began in February 1949.

Heat generated in "Bepo" reportedly is being used for space heating in the Harwell establishment.

On March 21, 1949, the Ministry of Supply announced it would purchase all uranium ores and concentrates of acceptable grade produced in British colonies during the subsequent ten years. A minimum price of 13s. 9d. was established per pound of contained U_3O_8, f. o. b. ocean port. The Ministry would not guarantee purchase of material assaying under 10 percent U_3O_8 or lots under 10 tons in weight. Prices above the minimum quoted might be paid in special cases where excessive costs would be a factor. Other terms would permit the Ministry to provide capital for installation of concentrating plants, if deemed advisable, and to finance mine development through grants-in-aid to any person producing and delivering, under the aforementioned terms, not less than 20 tons of ore or concentrate, 10 percent minimum U_3O_8, from a concession or mining lease not previously worked for uranium. No specific offer was made for thorium minerals but the Ministry stated it would discuss purchase terms with any prospective vendor.

AFRICA

Belgian Congo.—The Shinkolobwe mine of the Union Minière du Haut Katanga is the world's largest producer of high-grade uranium ore, and constitutes one of the main sources of uranium metal used by the United States. Uranium ores have been reported to occur in the Luiswishi copper-cobalt mine[12] of the Union Minière, about 15 kilometers north of Elizabethville.

Union of South Africa.—United States and United Kingdom representatives have been conducting informal discussions with the Union Government over a period of years on the problem of producing uranium from the gold ores of the Witwatersrand and its extensions.[13] Uranium is present as uraninite[14] and in radioactive carbonaceous matter,[15] and for years its presence has been known in osmiridium concentrates produced from the Rand. In 1948 it was reported that uranium had been found in almost every mine, and in the Orange Free State boreholes. The content of uranium, per ton, in the Rand ores is exceedingly small, but might possibly be recovered from some milling operations as a byproduct.

ASIA AND AUSTRALIA

Australia.—Crown ownership of minerals is vested in the Governments of the respective States, the Commonwealth Government exercising authority by virtue of its defense powers. The Commonwealth offers rewards up to £A25,000 for the discovery of uranium-ore deposits and will purchase uranium ores and concentrates containing not less than 5 percent U_3O_8.

Uranium ores of probable commercial importance occur in South Australia at Mount Painter about 300 miles north of Adelaide and 60 miles east of Copley, and at Radium Hill, near Olary, about 70 miles west of Broken Hill. An area of about 150 square miles in the Mount Painter locality has been under intensive geological study by the South Australian Government since June 1946, with diamond drilling and

[12] Charrin, Victor, Uranium Minerals of the Upper Katanga: Genie civil, vol. 125, 1948, p. 475.
[13] U. S. Department of State Bulletin, U. S., U. K., and South Africa to Discuss Uranium Production: Vol. 20, No. 521, June 26, 1949, p. 830.
[14] Chemical Age, South African Source of Uranium: Vol. 61, No. 1587, Dec. 10, 1949, pp. 791–792.
[15] Mining Magazine (London), vol. 81, No. 3, September 1949, p. 159.

underground development proceeding apace.[16] The deposit is reported to consist of primary uranium minerals disseminated in granite and pegmatite. Principal uranium minerals in ore mined so far have been torbernite and autunite, secondary minerals extensively developed in the near-surface oxidized zone. Ore at Mount Painter is much lower grade than that at Radium Hill, its eventual exploitation involving large-scale open-pit operations. The Radium Hill deposit, under exploration during the past 2 years, is reported to be of much greater significance than previously thought.[17] Ore minerals at Radium Hill are carnotite and davidite, a uraniferous ilmenite.

India.—The Government entered a 15-year agreement with two French firms, Banque Marocaine de Credit and Société de Produits Chimiques des Terres Rares, whereby the French companies would construct a monazite-processing plant in India.[18] Funds for construction are to be provided by the Government of India (55 percent) and the Government of Travancore (45). The plant will be operated by French-trained Indian personnel. The proposed annual capacity of the works would be 1,500 tons of monazite concentrates. Thorium nitrate and rare-earth compounds will be produced. Thorium content of Indian monazite averages about 9 percent ThO_2.

[16] Mining Magazine, South Australian Uranium: Vol. 80, No. 3, March 1949, pp. 187-188.
[17] Mining Magazine, vol. 81, No. 3, September 1949, p. 165.
[18] Metal Bulletin, No. 3425, Sept. 16, 1949, p. 13. Mining Journal (London), vol. 233, No. 5943, July 16, 1949, p. 627.

Vanadium

By Hubert W. Davis

GENERAL STATEMENT

FOR security reasons, publication of figures on production and consumption of vanadium ore in the United States since 1947 has been suspended.

DOMESTIC PRODUCTION

The center of domestic vanadium-ore mining in the United States is the Colorado-Utah region. Small outputs are made in Arizona, Nevada, and New Mexico, and vanadium-bearing phosphate rock is mined in Idaho.

Recovery of vanadium in vanadium-bearing phosphate ores is the subject of United States Patent 2,467,039, and a process for the treatment of vanadium-bearing iron ores is the subject of United States Patent 2,482,311.

Vanadium in ores and concentrates produced in the United States, 1938–47 [1]

Year	Vanadium, pounds	Year	Vanadium, pounds
1938	1,613,155	1943	5,586,492
1939	1,984,068	1944	3,527,054
1940	2,162,916	1945	2,963,913
1941	2,513,051	1946	1,272,148
1942	4,439,130	1947	2,117,962

[1] Data for 1940–47 are receipts at mills and Government purchasing depots.

USES

About 90 percent of the vanadium used is consumed as ferrovanadium in the manufacture of tool steels, engineering steels, high-strength structural steels, nonaging rimming steels, and special wear-resistant cast irons. Some ferrovanadium is used in welding-electrode coatings and as a deoxidizer,[1] and some metal is utilized in magnets. Some vanadium oxide is also used in the production of tool steel. The largest uses of vanadium oxide and ammonium metavanadate are as catalysts, in glass and ceramic glazes, for driers in paints and inks, and for laboratory research.

[1] Iron Age, Vanadium as a Deoxidizer: Vol. 164, No. 20, Nov. 17, 1949, pp. 97–102.

PRICES

For many years vanadium ore has been quoted at 27½ cents a pound of contained V_2O_5. This quotation, however, disregards the grade of the ore or the presence or absence of objectionable impurities—matters of importance to the refiners, inasmuch as impurities vitally affect recovery. Throughout 1949 vanadium pentoxide (technical grade) was quoted at $1.00 to $1.20 a pound of V_2O_5 and ferrovanadium at $2.90–$3.10 a pound of contained vanadium (depending upon the grade of the alloy).

FOREIGN TRADE[2]

Imports of vanadium concentrates (all from Peru) were 551,337 pounds (contained vanadium) in 1949, a decrease of 48 percent from 1948. There were no imports of flue dust containing vanadium or of ferrovanadium or vanadium oxide in 1949. Vanadium ore and concentrates enter the United States free of duty. However, the rate of duty on ferrovanadium is 12½ percent ad valorem and on vanadic oxide, anhydride, salts, and compounds and mixtures of vanadium 40 percent ad valorem.

Vanadium ore or concentrates and vanadium-bearing flue dust imported for consumption in the United States, 1940–49

Year	Vanadium ore or concentrates			Vanadium-bearing flue dust		
	Pounds		Value	Pounds		Value
	Gross weight	Vanadium content		Gross weight	Vanadium content	
1940	45,102,004	2,574,951	$1,216,705	(1)	(1)	(1)
1941	24,645,686	2,138,608	1,012,991	(1)	(1)	(1)
1942	36,492,268	2,422,376	1,274,483	624,423	154,028	$29,545
1943	22,117,131	2,052,620	1,080,150	748,749	64,393	53,553
1944	4,247,490	1,284,603	633,719	191,901	40,171	28,059
1945	8,776,328	1,550,479	725,362	133,795	26,293	19,378
1946	2,784,349	791,057	390,077	97,750	20,931	13,480
1947	3,274,548	983,869	448,076	143,124	71,819	15,483
1948	4,034,509	1,051,675	534,374			
1949	2,028,980	551,337	272,124			

[1] Not separately recorded.

Exports of vanadium ore and concentrates were 23,447 pounds (contained vanadium) valued at $26,266 in 1949, compared with 13,180 pounds valued at $32,263 in 1948. The 1949 exports comprised 10,091 pounds to Belgium, 9,436 pounds to Italy, 3,070 pounds to Austria, and 850 pounds to Canada. Exports of ferrovanadium were 194,655 pounds (gross weight) valued at $350,558 in 1949, compared with 238,824 pounds valued at $390,428 in 1948. The 1949 exports comprised 80,273 pounds to Canada, 69,193 pounds to Austria, 33,069 pounds to Italy, 8,960 pounds to Korea, and 3,160 pounds to Brazil.

[2] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

WORLD REVIEW

World production of vanadium ores is limited almost entirely to four countries—Northern Rhodesia, Peru, South-West Africa, and the United States. From 1940 through 1947 output from these sources ranged from 1,400 to 4,400 metric tons, and from 1941 through 1947 the United States was the leading producer.

Vanadium has also been recovered commercially from phosphate rock, iron ore, chrome ore, magnetite beach sands, caustic-soda solution employed in Bayer process of refining bauxite, naphtha soot collected from the smokestacks of ships and industrial plants, and vanadiferous ashes derived from asphaltites.

Because complete information on the quantity of vanadium recovered as byproducts of iron ore and other raw materials is lacking, it is not possible to determine world production of vanadium from all sources. Consequently, the accompanying table reflects only the production of vanadium in ores and concentrates for the countries listed, plus the quantity recovered in the United States as a byproduct of phosphate rock.

World production of vanadium in ores and concentrates, 1940–49, in metric tons

[Compiled by Berenice B. Mitchell]

Country	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
Argentina	1	6	------	------	4	3	6	7	(1)	(1)
Mexico	32	(2)	------	------	------	------	------	------	------	------
Northern Rhodesia	368	342	388	426	254	219	68	56	173	153
Peru	1,214	1,017	1,010	847	514	688	322	435	511	456
South-West Africa	428	269	453	577	385	420	430	282	187	165
United States (shipments) [3]	981	1,140	2,014	2,534	1,600	1,344	577	961	(4)	(4)
Total [5]	3,024	2,774	3,865	4,384	2,757	2,674	1,403	1,741	(4)	(4)

[1] Figure not available.
[2] Less than 1 ton.
[3] Includes also vanadium recovered as a byproduct of phosphate-rock mining.
[4] Bureau of Mines not at liberty to publish figure.
[5] Total represents data only for countries shown in table and excludes vanadium in ores produced in French Morocco, Spain, and U. S. S. R., for which figures are not available; the total also excludes quantities of vanadium recovered as byproducts from other ores and raw materials.

Argentina.—Vanadium occurs in small deposits widely scattered in the Provinces of Córdoba and San Luis. A small quantity of ore is mined for the production of 3 to 5 metric tons of vanadium pentoxide annually.

China.—According to Foreign Commerce Weekly:[3]

> After 3 years of work, the Metallurgical Research Institute of the Enterprise Department of the North China People's Government has successfully concluded research in the extraction, refining, and utilization of vanadium-bearing magnetite-ilmenite. This important ore is produced in Tamiao and Heishan districts of Luanp'ing hsien, Jehol Province. Of outstanding importance was the discovery of a method whereby vanadium and magnetite-ilmenite could be extracted commercially from the ores. The vanadium-bearing magnetite-ilmenite in the Tamiao and Heishan districts is the only source of vanadium and magnetite-ilmenite yet discovered in China. * * *
>
> Preliminary estimates place the mine's deposit at about 2,000,000 tons, but some geologists have discovered outcroppings of similar ore in Miyun ad Tsunhua, considered to be an extension of the Luanp'ing mineral vein. The ore has strong magnetic qualities, and is steel-gray in color, estimated to contain 55 percent iron, 14 percent magnetite-ilmenite, and 0.3 percent vanadium.

[3] Foreign Commerce Weekly, Magnetite-Ilmenite Development in China: Vol. 37, No. 11, Dec. 12, 1949, p. 31.

Northern Rhodesia.—The Rhodesia Broken Hill Development Co., Ltd., was again the only producer of vanadium in Northern Rhodesia. Output of vanadium oxide was 293 long tons averaging 91.89 percent V_2O_5 in 1949 compared with 331 tons averaging 92.06 percent V_2O_5 in 1948. During 1949 the feed to the gravity concentrating plant was 21,348 short tons of material averaging 1.3 percent V_2O_5, which consisted largely of vanadium-bearing laterites and washing-plant fines. Leach-grade material produced at the gravity plant was 3,649 short tons containing 137 tons of V_2O_5, the recovery being 49.3 percent. Feed to the vanadium leach plant was 13,506 short tons of material assaying 3.06 percent V_2O_5, and the recovery was 72.2 percent and the acid factor 23.52 pounds of sulfuric acid per pound V_2O_5 in fused vanadium pentoxide produced.

Peru.—The famous Mina Ragra mine of the Vanadium Corp. of America in the Andes near Ricran, Department of Junin, has been an important source of vanadium since 1907, when production was begun. Output in Peru was 814 metric tons V_2O_5 in 1949 compared with 913 tons V_2O_5 in 1948.

South-West Africa.—The Abenab West lead-vanadium mine of the South-West Africa Co., Ltd., was the only producer of vanadium in South-West Africa in 1949. Output of ore and concentrates (V_2O_5 content) was 324 short tons in 1949 compared with 368 tons in 1948. Exports of ore and concentrates (V_2O_5 content) were 746 short tons, of which 264 tons went to France, 278 tons to the United Kingdom, and 204 tons to the Netherlands.

Zinc[1]

By Richard H. Mote and Esther B. Miller

GENERAL SUMMARY

DOMESTIC zinc smelters produced the largest quantity of slab zinc in the peacetime history of the industry in 1949. Output, up 2 percent over the 1948 level, totaled nearly 870,000 short tons, 68 percent of which came from domestic ores, 26 percent from foreign ores, and the remaining 6 percent from secondary sources. The use of foreign ores dropped from 1948, and production of slab zinc from this source fell 11 percent to the lowest level since 1941. Redistilled secondary slab-zinc production also declined in 1949. Output of slab zinc from domestic ores, however, increased 10 percent over 1948 and was the largest since 1943. Domestic mine output of recoverable zinc fell 6 percent from 1948 and, except for 1946 when extended labor strikes paralyzed the industry, was the smallest since 1939. Idaho continued to lead the States in zinc mine production. A 23,322-ton drop in imports of zinc in ores and concentrates was more than offset by a 33,693-ton gain in slab-zinc imports. The decline in imports of zinc ores and concentrates and the drop in domestic mine production reduced the current supply of raw materials available for smelting requiring a draft on smelters' stocks of zinc concentrates, which reduced them 92,000 tons or nearly 23 percent during the year. As the over-all supply of zinc metal exceeded consumers' needs during most of the year, producers' inventories pyramided to nearly 4½ times the quantity on hand at the beginning of the year. Consumers' stocks on December 31 were 16 percent under the January 1 inventory. The increasing availability of slab zinc was accompanied by a downward price readjustment from a high of 17.50 cents per pound to a low of 9 cents. At the end of the year one producer quoted the price at 10 cents, but most sales were at 9.75 cents.

DOMESTIC PRODUCTION

Statistics on zinc production are compiled both on a mine basis and on a smelter basis. The mine-output data, based upon the zinc content of ores and concentrates produced (adjusted to account for average smelting losses), are the most precise measure of zinc output from year to year. Smelter production of slab zinc presents a more accurate figure of actual zinc recovery but usually differs from the mine figure owing to overlap or lag between mine shipments and smelter receipts and treatment of ores and concentrates. Over a period of years, however, these variations tend to balance within the limits of statistical error.

[1] This report deals primarily with the smelter branch of the industry. Full details of zinc mining are given in the various State reports of this volume. As some zinc ore is used directly in the manufacture of zinc pigments, see also the chapter on Lead and Zinc Pigments and Zinc Salts.

Salient statistics of the zinc industry in the United States, 1940–44 (average) and 1945–49

	1940-44 (average)	1945	1946	1947	1948	1949
Production of primary slab zinc:						
By sources:						
From domestic ores......short tons..	608,249	467,084	459,205	510,058	537,966	591,454
From foreign ores............do.....	231,906	297,477	269,057	292,437	249,798	223,328
Total.......................do.....	840,155	764,561	728,262	802,495	787,764	814,782
By methods:						
Electrolytic........percent of total..	31	35	39	37	40	40
Distilled......................do.....	69	65	61	63	60	60
Production of redistilled secondary slab zinc.......................short tons..	51,773	49,242	44,516	59,542	62,320	55,041
Stocks on hand at primary smelters Dec. 31...................short tons..	105,549	254,692	175,513	67,046	19,179	90,787
Price:						
Prime Western at St. Louis:						
Average for period.cents per pound..	7.71	8.25	8.73	10.50	13.58	12.15
Highest quotation............do.....	8.25	8.25	10.50	10.50	17.50	17.50
Lowest quotation.............do.....	5.50	8.25	8.25	10.50	10.50	9.00
Yearly average at London.......do.....	4.63	5.18	7.75	12.58	14.38	14.41
Mine production of recoverable zinc short tons..	729,011	614,358	574,833	637,608	629,977	593,203
Tri-State district (Joplin) percent of total..	31	23	24	17	14	13
Western States...............do.....	41	48	48	54	58	60
Other..........................do.....	28	29	28	29	28	27
World smelter production of zinc short tons..	1,904,000	1,404,000	1,550,000	1,759,000	1,865,000	1,995,000

MINE PRODUCTION

Zinc mining is centered largely in five areas—the Tri-State area of southeastern Kansas, southwestern Missouri, and northeastern Oklahoma; Tennessee-Virginia; Sussex County, N. J.; St. Lawrence County, N. Y.; and the Western States (principally Idaho, Arizona, Montana, Colorado, Utah, New Mexico, Nevada, and Washington, in descending order of productivity in 1949).

Mine production in the combined Western States declined 2 percent in 1949 as compared with 1948. Over 60 percent of the total domestic output of zinc in 1949 (58 percent in 1948) was produced in the Western States. Although the output of recoverable zinc in Idaho dropped 11 percent in 1949, the State continued to be the largest zinc-producing State in the United States. The Star mine near Burke in the Coeur d'Alene region remained the largest Idaho producer of zinc; it was followed by the Page, Morning, Sidney, Bunker Hill & Sullivan, Frisco, Amazon-Carlisle, Spokane-Idaho, Highland-Surprise, and Tamarack. These 10 properties, all in the Coeur d'Alene region, produced 80 percent of the State total. Over 97 percent of the State total zinc in 1949 came from the Coeur d'Alene region and most of the remainder from the Warm Springs district. Zinc-lead ore and old tailings concentrated yielded 93 percent of the State total zinc; old zinc slag smelted and fumed, 3 percent; and zinc ore and lead ore concentrated, 3 percent. Arizona zinc output in 1949 was far greater than in any year in the State's history. The Copper Queen mine at Bisbee, by far the largest zinc producer in the State in 1949, increased its output 28 percent over 1948. Other large producers of zinc were the Iron King mine at Humboldt, the San Xavier mine south of Tucson, the St. Anthony property at Tiger, the United Verde operations at Jerome, the Flux-January-Norton group near Patagonia, the Republic and Mammoth (Coronado Copper & Zinc Co.) properties

in Cochise County and the Old Dick mine in Yavapai County. More than 86 percent of the zinc production in 1949 was recovered from zinc-lead ore and most of the remainder from zinc-copper and zinc ore. With the exception of the Travona and Mike Horse mines, all the larger zinc producers in Montana reported declines in 1949. Decreases were particularly marked at Butte from June through September, following sharp breaks in the price of zinc. The leading zinc producers in 1949 were the Butte Hill mine and dumps (72 percent of the State total) and the Emma mine at Butte, the Mike Horse mine at Flesher, the East Helena old slag dump, an old slag dump in Cascade County, and the Travona mine, which together supplied 97 percent of the total. Of Montana zinc in 1949, 93 percent was derived from zinc-lead ore and old slag and nearly all the remainder from gold and silver ores and lead ore. Mine production of recoverable zinc in Colorado increased 6 percent over 1948 to reach the highest level since 1917. All the leading zinc producers that were active in 1948 except the Rico Argentine mine in Dolores County continued operations throughout 1949. The five leading zinc producers, in order of output, were: New Jersey Zinc Co. Eagle mine, Eagle County; American Smelting & Refining Co. Kokomo unit, Summit County; Idarado Mining Co. Treasury Tunnel–Black Bear group, San Miguel County; Resurrection Mining Co. Resurrection group, Lake County; and Telluride Mines (Inc.) Smuggler Union group, San Miguel County.

Utah zinc production declined 2 percent from the 1948 output. Production dropped sharply at the Tooele old-slag dump, New Park property, Silver King mine, and Pacific Bridge property. Increases were reported from the Butterfield group, Chief Consolidated property, Park Utah Consolidated property, and Hidden Treasure mine. Leading producers of the metal in 1949, in order of output, were the United States & Lark group properties of the Chief Consolidated Mining Co., Park Utah Consolidated Mines Co., New Park Mining Co., Butterfield group, Calumet mine, Tooele old-slag dump, Hidden Treasure mine, Pacific Bridge property, and Silver King Coalition mine. These 10 producers contributed 97 percent of the State total zinc. Mine production of recoverable zinc in New Mexico dropped 29 percent in 1949 and was the lowest since 1938. The nearly 49-percent decline in the price of zinc from March to June, with high production costs continuing, led to the closing by July 15 of all but one of the seven major zinc-producing mines and most of the small-scale operations. The output of recoverable zinc in the latter half of the year was only 5,749 tons compared with 23,597 tons in the first half. Large producers that suspended operations were the American Smelting & Refining Co. Ground Hog mine, the United States Smelting, Refining & Mining Co. Bayard group, the Kennecott Copper Corp. Oswaldo mine, the Peru Mining Co. Pewabic mine, the New Mexico Consolidated Mining Co. Kearney mine, all in the Central district, Grant County; and the Waldo mine of the American Smelting & Refining Co. at Magdalena, Socorro County. The first five of the foregoing mines were among the six leading producers of zinc in the State in 1949; the largest producer, the Empire Zinc Co. Hanover mine group in the Central district, operated throughout the year. Despite one of the severest winters on record and sharp declines in base-metal market prices, the Nevada mine output of recoverable

zinc in 1949 was slightly greater than the 1948 production. The Pioche district and adjacent Comet district, Lincoln County, together produced 92 percent of the State's zinc in 1949. The State's leading producers in the order named were: The Combined Metals Reduction Co. and Ely Valley Mines, Inc., both in the Pioche district; Copper Canyon Mining Co., Battle Mountain district, Lander County; and L. F. Jacobson (Yellow Pine Mine), Yellow Pine district, Clark County. In Washington the property of the Pend Oreille Mines & Metals Co. made a large increase in zinc output in 1949, but declines from the Holden, Deep Creek, and Grandview mines resulted in a net drop of 15 percent in the State total output compared with 1948. Leading zinc producers in 1949, in order of output, were the property of the Pend Oreille Mines & Metals Co. and the Holden, Grandview, and Deep Creek mines, which together contributed 96 percent of the total zinc. Zinc-lead ore supplied over 59 percent of the zinc in 1949, zinc-copper ore 25 percent, and zinc ore 15 percent. Mine production of zinc in California increased 35 percent over 1948. The Anaconda Copper Mining Co. continued to be the State's principal producer of zinc and lead. The company's Darwin and Shoshone mines were operated throughout the year except for a period from July through part of September when falling metal prices forced closure of the properties. Other important zinc mines operated in California during the year included the Penn mine in the Campo Seco district, Calaveras County; the Carbonate King Zinc mine in the Clark Mountain

Mine production of recoverable zinc in the United States, 1940–44 (average) and 1945–49, by States, in short tons

State	1940-44 (average)	1945	1946	1947	1948	1949
Western States and Alaska:						
Alaska				25	22	2
Arizona	19,845	40,226	43,665	54,644	54,478	70,658
California	2,289	9,923	6,877	5,415	5,325	7,209
Colorado	27,409	35,773	36,147	38,745	45,164	47,703
Idaho	83,004	83,463	71,507	83,069	86,267	76,555
Montana	48,349	17,403	16,770	45,679	59,095	54,195
Nevada	14,301	21,457	22,649	16,970	20,288	20,443
New Mexico	44,978	40,295	36,103	44,103	41,502	29,346
Oregon		1		1		6
South Dakota	43			19	29	
Texas			44	22		
Utah	43,454	33,630	28,292	43,673	41,490	40,670
Washington	12,877	11,693	11,329	13,800	12,638	10,740
Total	296,549	293,864	273,383	346,165	366,298	357,527
West Central States:						
Arkansas	188	303	85	18	31	1
Kansas	60,991	48,394	47,703	41,497	35,577	29,433
Missouri	27,614	22,175	22,234	17,074	6,463	5,911
Oklahoma	136,316	69,300	69,552	51,062	43,821	44,033
Total	225,109	140,172	139,574	109,651	85,892	79,378
States east of the Mississippi River:						
Illinois	7,303	8,310	8,798	10,073	12,980	18,157
Kentucky	677	182	314	508	639	935
New Jersey	90,478	81,392	64,454	76,871	76,332	50,984
New York	40,296	24,978	32,515	34,116	34,566	37,973
Tennessee	39,507	33,824	24,614	31,212	29,524	29,788
Virginia	18,820	16,075	16,905	16,788	15,882	13,166
Wisconsin	10,274	15,561	14,276	12,224	7,864	5,295
Total	207,353	180,322	161,876	181,792	177,787	[illegible]
Grand total	729,011	614,358	574,833	637,608	629,977	[illegible]

district of San Bernardino County; and the Afterthought mine in the Cow Creek district, Shasta County. In Oregon a small tonnage of zinc was recovered from zinc-lead ore mined at the Helena Mines, Inc., Helena and Musick properties in the Bohemia district of Lane County.

Mine production of recoverable zinc in the United States, 1948–49, by months, in short tons

Month	1948	1949	Month	1948	1949
January	48,548	51,966	August	50,073	45,289
February	48,758	53,235	September	53,393	42,268
March	55,356	62,395	October	54,624	39,219
April	53,752	59,571	November	57,133	42,447
May	52,238	56,304	December	56,626	46,019
June	52,060	54,557			
July	47,416	39,933	Total	629,977	593,203

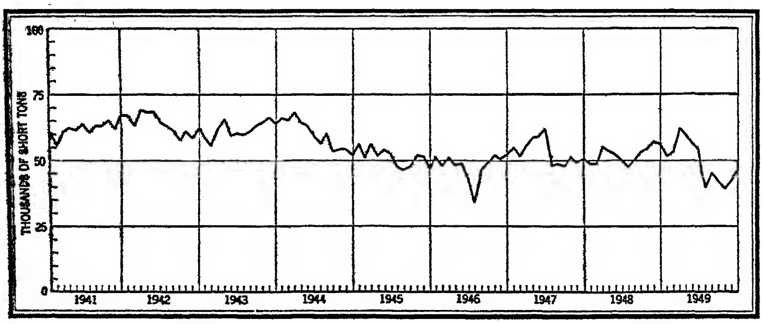

FIGURE 1.—Mine production of recoverable zinc in the United States, 1941–49, by months, in short tons.

Although mine output of zinc in Oklahoma increased slightly in 1949, production in Arkansas, Kansas, and Missouri continued to decline. Zinc production in the Tri-State district, decreasing for the eighth consecutive year, was 7 percent less than in 1948 and the lowest since 1896. In the first few months of 1949 concentrate prices were high enough to support the mining of low-grade ores, which constitute the bulk of the district reserves. Zinc output in March was the highest since June 1947. The sharp decline in the quoted price of zinc concentrates at Joplin—from $110 a ton for the week ended March 19 to a low of $50 June 18—disrupted virtually all operations, causing about 50 of the mines to shut down and most of the other 76 active mines to cut back output. The July production of zinc concentrates, reduced to an exceptionally low level by previous shut-downs and a work stoppage at the mines and mills of the Eagle-Picher Mining & Smelting Co., was only 3,529 tons compared with 18,256 tons in the peak month of March. From August through December the price received by the producers for zinc concentrates averaged $56.18 a ton, and the monthly production averaged 10,891 tons. The five leading zinc-producing companies in the district in 1949 were: Eagle-Picher Mining & Smelting Co., Nellie B. Mining Co., National Lead Co. St. Louis Smelting & Refining Division, Federal Mining & Smelting Co., and Sooner Milling Co.

Zinc production in States east of the Mississippi River decreased 12 percent from the 1948 output. Loss of production from New Jersey Zinc Co. mines in New Jersey, which were idle from September 27 through the end of the year because of a labor strike at the Palmerton (Pa.) zinc smelter, accounted for most of the decline.

In Kentucky and Southern Illinois the principal zinc producers were the Ozark-Mahoning Co. and the Minerva Oil Co. The slackening in demand for fluorspar from which zinc is produced as a byproduct in this district was the principal reason for a smaller zinc output in 1949 as compared with 1948. In New York the St. Joseph Lead Co. mines operated continuously throughout 1949. During the latter part of the year the Universal Exploration Co. curtailed production owing to the steel strike (October 1–November 12) which indirectly forced the closure of the Donora, Pa., zinc smelter.

In Tennessee the Tennessee Copper Co. made a small increase in zinc output. The American Zinc Co. of Tennessee suspended production at its Athletic mine June 17 but continued to operate the Grasselli, Jarnagin, and Mascot mines, except for a 3-week vacation period in July. Despite an inoperative period from October 7 to November 21, output from the Universal Exploration Co. mine near Jefferson City exceeded production in 1948.

In the Wisconsin-Northern Illinois district two new mines were opened. The Eagle-Picher Mining & Smelting Co. completed the Graham mill and began production from its properties a few miles north of Galena, Ill., and the Calumet & Hecla Consolidated Copper Co. built the Shullsburg mill and began operations at its properties in Wisconsin. The largest producer in the district was the Tri-State Zinc, Inc., which operated its Bautsch, Heer, and Black Jack mines. The Vinegar Hill Zinc Co., formerly the largest producer, closed its custom mill August 4.

The 25 leading zinc-producing mines in the United States in 1949, listed in the following table, yielded 60 percent of the total domestic zinc output; the 3 leading mines produced over 21 percent and the 6 leading mines nearly one-third.

Detailed information on the production of mines and districts in the United States may be found in the chapters of this volume dealing with the mine production of gold, silver, copper, lead, and zinc in the various States.

SMELTER PRODUCTION

During 1949, 19 primary zinc-reduction plants were in operation, of which 10 operated with horizontal retorts exclusively, 1 with both horizontal and vertical retorts, 3 with vertical retorts exclusively (1 electrothermic), and 5 with electrolytic methods.

Horizontal-Retort Plants.—The total number of retorts reported at active horizontal-retort primary plants in 1949 was 55,584, a 6-percent decrease from the 59,168 retorts on December 31, 1948, at plants that operated during that year. Of the total retorts reported, 51,652 (93 percent) were in use at the close of 1949, compared with 53,332 (90 percent) in operation at the end of 1948.

Vertical-Retort Plants.—Four vertical-retort continuous distilling plants operated during 1949. The St. Joseph Lead Co. operated its 13 electrothermic units at Josephtown, Pa., at about 87 percent of capacity throughout the year. Of the 66 vertical retorts at the remaining 3 plants, 63 were in operation on December 31, 1949.

Twenty-five leading zinc-producing mines in the United States in 1949, in order of output

Rank	Mine	District	State	Operator	Type of ore
1	Franklin & Sterling Hill	New Jersey	New Jersey	New Jersey Zinc Co.	Zinc.
2	Butte Hill mine and dumps	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co.	Zinc-lead.
3	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp.	Do.
4	Balmat	St. Lawrence County	New York	St. Joseph Lead Co.	Do.
5	United States & Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Do.
6	Eagle	Red Cliff	Colorado	Empire Zinc Division, New Jersey Zinc Co.	Zinc.
7	Star	Hunter	Idaho	Sullivan Mining Co.	Zinc-lead.
8	Pioche	Pioche	Nevada	Combined Metals Reduction Co.	Do.
9	Austinville	Austinville	Virginia	New Jersey Zinc Co.	Do.
10	Mascot No. 2	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Zinc.
11	Page	Yreka	Idaho	Federal Mining & Smelting Co.	Zinc-lead.
12	Edwards	St. Lawrence County	New York	St. Joseph Lead Co.	Zinc.
13	Kokomo Unit	Ten Mile	Colorado	American Smelting & Refining Co.	Zinc-lead.
14	Iron King	Big Bug	Arizona	Shattuck Denn Mining Corp.	Do.
15	Hanover Mine group	Central	New Mexico	Empire Zinc Division, New Jersey Zinc Co.	Zinc.
16	Emma	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co.	Zinc-lead.
17	San Xavier	Pima	Arizona	Eagle-Picher Mining & Smelting Co.	Do.
18	Walter Hartley	Tri-State	Kansas	St. Louis Smelting & Refining Co.	Zinc.
19	Bautsch	Northern Illinois	Illinois	Tri-State Zinc, Inc.	Zinc-lead.
20	Morning	Hunter	Idaho	Federal Mining & Smelting Co.	Do.
21	Davis-Bible group	Eastern Tennessee	Tennessee	Universal Exploration Co.	Zinc.
22	Chief, Gemini, etc.	Tintic	Utah	Chief Consolidated Mining Co.	Zinc-lead.
23	Grasselli	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Do.
24	Sidney	Yreka	Idaho	Sidney Mining Co.	Do.
25	Ground Hog group	Central	New Mexico	American Smelting & Refining Co.	Zinc.

Mine production of recoverable zinc in the United States, 1940–44 (average), by districts that produced 1,000 tons or more during any year, 1945–49, in short tons

District	State	1940–44 (average)	1945	1946	1947	1948	1949
Tri-State (Joplin region)	Kansas, southwestern Missouri, Oklahoma	223,999	139,274	139,038	109,338	84,839	78,628
Coeur d'Alene region	Idaho	74,889	78,030	67,429	79,251	83,801	74,370
New Jersey	New Jersey	90,476	81,392	64,454	76,871	76,332	50,984
Summit Valley (Butte)	Montana	23,807	8,364	7,108	40,712	52,625	47,982
St. Lawrence County	New York	40,296	24,978	32,515	34,116	34,566	37,973
Warren (Bisbee)	Arizona	2,889	18,078	22,374	32,546	27,669	35,393
Eastern Tennessee [1]	Tennessee	39,507	33,824	24,614	31,212	29,524	29,788
Central	New Mexico	40,692	36,245	32,279	38,155	35,140	26,376
West Mountain (Bingham)	Utah	21,500	14,670	7,593	20,446	22,077	22,311
Pioche	Nevada	12,819	16,575	15,764	14,362	18,612	18,651
Upper Mississippi Valley	Northern Illinois, Iowa,[2] Wisconsin.	11,528	19,318	18,344	17,077	14,061	17,846
Red Cliff	Colorado	16,621	15,805	16,437	17,375	16,355	17,450
Austinville	Virginia	18,206	16,000	16,905	16,788	15,882	13,166
Ten Mile	Colorado	633	2,142	2,490	4,587	10,338	9,710
Big Bug	Arizona	2,599	4,922	5,234	4,991	5,832	8,798
Park City region	Utah	13,569	7,435	8,876	10,956	10,320	8,359
Pima (Sierritas, Papago, Twin Buttes).	Arizona	1,312	3,697	3,948	4,727	5,758	7,177
Kentucky-Southern Illinois	Kentucky, Southern Illinois.	6,727	4,735	5,044	5,728	7,422	6,541
Metaline	Washington	11,582	7,794	7,685	9,754	5,985	6,496
California (Leadville)	Colorado	3,412	7,419	5,996	4,809	5,726	6,455
Tintic	Utah	1,702	2,928	3,710	3,969	3,680	6,082
Upper San Miguel	Colorado	486	1,458	1,963	2,067	3,486	6,004
Old Hat (Oracle)	Arizona	1,110	4,750	4,235	3,427	3,796	5,195
Verde (Jerome)	do					459	4,350
Coso	California	165	996	854	603	4,497	4,062
Harshaw	Arizona	3,304	1,666	1,128	2,006	2,875	2,947
Chelan Lake [3]	Washington	601	2,419	1,730	1,000	3,289	[3] 2,724
Eureka (Bagdad)	Arizona	235	425	325	257	2,321	2,304
Magdalena	New Mexico	3,147	3,044	3,474	5,013	4,856	2,263
Rush Valley and Smelter (Tooele County).	Utah	[4] 6,614	7,720	6,365	5,642	3,552	2,188
Heddleston	Montana	859	1,878	1,516	1,482	1,437	2,026
Cochise	Arizona	66	1,300	2,877	3,143	2,875	1,760
Warm Springs	Idaho	6,128	2,797	2,161	2,791	1,545	1,635
Smelter (Lewis and Clark County).	Montana	19,638	2,235	4,995	748	3,417	1,463
Tomichi	Colorado	169	430	440	1,684	1,983	1,456
Northport	Washington	628	1,410	1,790	2,788	3,271	1,412
Pioneer (Rico)	Colorado	3,318	3,920	3,435	3,433	3,180	1,354
Smelter (Cascade County)	Montana						1,278
Sneffels	Colorado	225	361	(5)	(5)	815	1,053
Animas	do	731	795	1,590	1,310	748	1,029
Ophir	Utah	234	54	294	987	786	1,004
Aravaipa	Arizona	68	333	152	20	1,098	783
Campo Seco	California	142	2,134	3,301	2,350		363
Breckenridge	Colorado	116	723	1,110	1,279	171	362
Pinos Altos	New Mexico	393	298	81	724	1,056	243
Eureka	Nevada	48	1,204	3,705	897	19	108
Cow Creek	California		178			(6)	(6)
Flat Creek	do	352	1,714	1,926	1,707		
Hunter Valley	do	669	3,311				
Pioneer (Superior)	Arizona	3,824	2,297				
Yankee Hill	California	370	1,251				

[1] Includes very small quantity produced elsewhere in State.
[2] No production in Iowa since 1917.
[3] Includes Peshastin Creek and Wenatchee River districts in 1949.
[4] 1941–44 average.
[5] Bureau of Mines not at liberty to publish.
[6] Bureau of Mines not at liberty to publish; not listed in order of output.

Electrolytic Plants.—Five electrolytic plants were in operation during 1949, as in 1948. There were 3,370 cells at the plants on December 31, 1949, of which 3,235 (96 percent) were in operation; the number of cells at the end of 1948 was 3,370, of which 3,310 (98 percent) were operating.

Smelting Capacity.—Irrespective of additions or subtractions of smelter recovery units, statistics on domestic smelting capacity vary from year to year owing to changes in metallurgical practices among the various plants. According to reports to the Bureau of Mines, the zinc-reduction plants in the United States on December 31, 1949, had a stated annual capacity to produce 1,035,179 tons of slab zinc under normal operating conditions, allowing for necessary shut-downs for repairs. This figure, which compares with a 1,010,933-ton reported capacity at the end of 1948, indicates that the 1949 output was 84 percent of the capacity. Horizontal- and vertical-retort plants operated at 82 percent of a stated 620,595-ton capacity (82 percent of a 610,697-ton capacity in 1948), electrolytic plants at 90 percent of a 362,500-ton capacity (91 percent of a 345,172-ton capacity in 1948), and secondary smelters at 62 percent of a 52,084-ton capacity (58 percent of a 55,064-ton capacity in 1948).

Waelz Kilns.—The following companies operated Waelz kilns in 1949:

Arkansas:
- Fort Smith—The Residue Co.

Illinois:
- Danville—The Hegeler Zinc Co.
- Fairmont City—American Zinc Co. of Illinois.
- La Salle—Matthiessen & Hegeler Zinc Co.

Kansas:
- Cherryvale—National Zinc Co., Inc.

Oklahoma:
- Henryetta—Eagle-Picher Mining & Smelting Co.

Pennsylvania:
- Donora—American Steel & Wire Co.
- Palmerton—New Jersey Zinc Co.

Slag-Fuming Plants.—The following companies operated slag-fuming plants in 1949 and produced impure zinc oxide, which was further treated for the recovery of slab zinc:

Idaho:
- **Bradley—Bunker Hill & Sullivan Mining & Concentrating Co.**

Montana:
- **East Helena—Anaconda Copper Mining Co.**

Texas:
- **El Paso—American Smelting & Refining Co.**

Utah:
- **Tooele—International Smelting & Refining Co.**

During 1949 these four plants treated 613,615 tons of hot and cold slag, which yielded 98,263 tons of oxide fume containing 65,854 tons of recoverable zinc. Corresponding figures for the four operating plants in 1948 were 510,581, 87,104, and 53,394 tons, respectively.

Active Zinc-Reduction Plants.—During 1949 a new block of furnaces was added at the National Zinc Co., Bartlesville, Okla., plant. The new unit, constructed during the first half of the year and put into operation in June, contains 832 retorts and is designed to handle 50 tons of sintered zinc material per 48-hour cycle. Improvement in metallurgical techniques at other horizontal retort plants was evidenced by progress in mechanical charging of retorts at the Amarillo, Tex., plant of the American Smelting & Refining Co. and the installation of a new rod mill at the Dumas, Tex., plant of the American Zinc Co. of Illinois. The new mill mixes retort charges immediately before charging into the retorts and is said to provide a heavier charge per retort.

A new type of condenser developed by the New Jersey Zinc Co. for use with vertical retorts in the continuous distillation of zinc was put into commercial operation during the year. This innovation in the field of metal vapor condensation employs a motor-driven graphite impeller within the condenser to generate showers of molten zinc for scrubbing or cleaning zinc metal from the gas-vapor stream of the retorts. Water-cooled coils within the zinc bath maintain the temperature of the molten metal at 500°.

A list of the zinc-reduction plants operating in the United States in 1949 follows:

Primary zinc distillers

Horizontal-retort plants

Arkansas:
- Fort Smith—Athletic Mining & Smelting Co.

Illinois:
- Fairmont City—American Zinc Co. of Illinois.
- La Salle—Matthiessen & Hegeler Zinc Co.

Oklahoma:
- Bartlesville—National Zinc Co., Inc.
- Blackwell—Blackwell Zinc Co.
- Henryetta—Eagle-Picher Mining & Smelting Co.

Pennsylvania:
- Donora—American Steel & Wire Co.
- Palmerton—The New Jersey Zinc Co. of Pennsylvania.

Texas:
- Amarillo—American Smelting & Refining Co.
- Dumas—American Zinc Co. of Illinois.

Vertical-retort plants

Illinois:
- Depue—The New Jersey Zinc Co.

Pennsylvania:
- Josephtown—St. Joseph Lead Co.
- Palmerton—The New Jersey Zinc Co. of Pennsylvania.

West Virginia:
- Meadowbrook—E. I. du Pont de Nemours & Co., Inc.

Electrolytic plants

Idaho:
- Kellogg—Sullivan Mining Co.

Illinois:
- Monsanto—American Zinc Co. of Illinois.

Montana:
- Anaconda—Anaconda Copper Mining Co.
- Great Falls—Anaconda Copper Mining Co.

Texas:
- Corpus Christi—American Smelting & Refining Co.

Secondary zinc distillers

Alabama:
- Fairfield—W. J. Bullock, Inc.

California:
- Los Angeles—American Smelting & Refining Co., Federated Metals Division.
- Torrance—Pacific Smelting Co.

Illinois:
- Beckemeyer—American Smelting & Refining Co., Federated Metals Division.
- Hillsboro—American Zinc, Lead & Smelting Co.
- Sandoval—Sandoval Zinc Co.

New Jersey:
- Trenton—American Smelting & Refining Co., Federated Metals Division.

Oklahoma:
    Sand Springs—American Smelting & Refining Co., Federated Metals Division.
Pennsylvania:
    Bristol—Superior Zinc Corp.
    Philadelphia—General Smelting Co.
West Virginia:
    Wheeling—Wheeling Steel Corp.

PRIMARY AND REDISTILLED SECONDARY SLAB ZINC

The output of primary slab zinc in 1949 advanced 3 percent over the 1948 production. Although the use of foreign concentrates declined and the slab zinc produced from this source fell 11 percent, output from domestic ore rose 10 percent to the highest level since 1943.

Production of redistilled slab zinc from zinc scrap dropped 12 percent from the 1948 record level. Of the 55,041 short tons of redistilled secondary slab zinc produced in 1949, 22,782 tons (41 percent) were derived from primary smelters, and 32,259 tons (59 percent) were produced at secondary plants. Data on output of remelted secondary slab zinc are not included with those for redistilled metal. In 1949 the production of slab zinc recovered by remelting purchased scrap was 6,045 tons (7,796 tons in 1948). Zinc rolling mills and other substantial consumers of slab zinc recover large quantities of zinc from their own plant scrap; but such metal is not measured statistically, for it seldom enters the market as scrap.

Primary and redistilled secondary slab zinc produced in the United States, 1940–44 (average) and 1945–49, in short tons

Year	Primary			Redistilled secondary	Total (excludes zinc recovered by remelting)
	Domestic	Foreign	Total		
1940–44 (average)	608,250	231,906	840,156	51,773	891,929
1945	467,084	[1] 297,477	764,561	49,242	813,803
1946	459,205	269,057	728,262	44,516	772,778
1947	510,058	292,437	802,495	59,542	862,037
1948	537,966	249,798	787,764	62,320	850,084
1949	591,454	223,328	814,782	55,041	869,823

[1] Includes a small tonnage of foreign slab zinc further refined into high-grade metal in the United States.

Labor strikes continued in 1949 to exact a toll on the smelter output of slab zinc. The horizontal retort smelter at Fairmont City, Ill., and the secondary plant at Hillsboro, Ill., strikebound since August 1948, remained closed until the latter part of September and the end of August 1949, respectively. The vertical retort smelter at Palmerton, Pa., was closed by strike on September 26 and continued idle throughout the balance of the year. Labor-management disputes at lead-producing operations in Idaho's Coeur d'Alene region forced curtailment in zinc output from one-third to one-half capacity at the electrolytic plant in Kellogg, Idaho. The horizontal retort plant at Donora, Pa., was closed from September 30 to November 11, and the coal strike brought about a 50-percent reduction in output at the Meadowbrook, W. Va., smelter.

DISTILLED AND ELECTROLYTIC ZINC

Of the 1949 output of primary zinc, 60 percent was distilled and 40 percent was produced electrolytically.

Production of Regular High Grade, Brass Special, and Prime Western rose 5, 23, and 12 percent, respectively, in 1949. Output of Special High Grade dropped 7 percent to the lowest level since 1945 and production of Intermediate grade fell off 45 percent to the lowest point since 1932. A decline of 46 percent was recorded in output of Selected grade. Of the total 1949 production (comparable 1948 figures in parentheses), 40 percent (37 percent) was Prime Western, 27 percent (29 percent) Special High Grade, 24 percent (23 percent) Regular High Grade, 6 percent (5 percent) Brass Special, 3 percent (5 percent) Intermediate, and less than 1 percent (1 percent) Selected.

Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1945–49, in short tons

CLASSIFIED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled	Redistilled secondary [1]		Total
			At primary smelters	At secondary smelters	
1945	269,924	494,637	21,205	28,037	813,803
1946	281,295	446,967	18,408	26,108	772,778
1947	295,520	506,975	22,093	37,449	862,037
1948	312,477	475,287	28,070	34,250	850,084
1949	326,152	488,630	22,782	32,259	869,823

CLASSIFIED ACCORDING TO GRADE

Year	Grade A		Grade B (Intermediate)	Grades C and D		Grade E (Prime Western)	Total
	Special High Grade (99.99% Zn)	Regular High Grade (Ordinary)		Brass Special	Selected		
1945	220,241	191,639	49,106	75,749	17,367	259,701	813,803
1946	236,184	180,366	32,294	75,296	13,697	234,941	772,778
1947	239,274	190,429	36,812	61,104	12,844	321,574	862,037
1948	248,346	196,482	38,892	45,946	4,723	315,695	850,084
1949	230,576	206,651	21,513	56,388	2,565	352,130	869,823

[1] For total production of secondary zinc see chapter on Secondary Metals—Nonferrous.

PRIMARY SLAB ZINC, BY STATES

Montana continued to be the leading producer of primary slab zinc in 1949; Oklahoma and Pennsylvania were in second and third places, respectively. Of the States for which production figures may be shown separately, Illinois, Idaho, and Arkansas occupied the next three positions. As usual, in Montana and Idaho slab zinc was produced by electrolytic methods only. In Illinois and Texas both electrolytic and distilled zinc metal was recovered, whereas in all other States zinc was recovered by distillation alone.

Primary slab zinc produced in the United States, by States where smelted, 1940–44 (average) and 1944–49, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Texas and West Virginia [1]	Total	
								Short tons	Value
1940–44 (average)	37,649	38,874	155,247	196,286	96,881	210,715	104,504	840,156	$135,034,000
1944	31,350	36,562	155,362	224,391	107,364	206,315	107,958	869,302	149,520,000
1945	29,391	33,110	124,904	179,251	106,115	200,709	91,081	764,561	131,504,492
1946	18,720	34,832	104,002	186,662	104,125	178,811	101,110	728,262	129,630,636
1947	17,158	41,801	113,192	197,453	128,398	193,524	110,969	802,495	171,894,429
1948	15,586	42,064	93,229	207,717	137,844	171,276	120,048	787,764	209,860,330
1949	17,316	41,854	86,823	216,578	157,650	156,920	137,841	814,782	202,391,849

[1] Includes Missouri, 1943–44 and 1947–49.

SECONDARY ZINC

In addition to the redistilled secondary slab zinc (unalloyed) already reported herein, some remelted slab zinc is produced, and a large quantity of secondary zinc is recovered each year in the form of alloys, zinc dust, zinc pigments, and zinc salts. Additional information on secondary zinc is given in the Secondary Metals—Nonferrous chapter of this volume.

BYPRODUCT SULFURIC ACID

Sulfuric acid made from the sulfur dioxide gases produced in roasting zinc blende (sphalerite) is an important byproduct of zinc smelting. To utilize a larger proportion of their acid-producing capacity, some plants also consume large quantities of native sulfur. The production of sulfuric acid at zinc-blende roasting plants decreased 20 percent in 1949.

Sulfuric acid (basis, 100 percent) made at zinc-blende roasting plants in the United States, 1945–49

Year	Made from zinc blende [1]		Made from native sulfur		Total [1]		
	Short tons	Value [2]	Short tons	Value [2]	Short tons	Value [2]	
						Total	Average per ton
1945	610,938	$7,944,478	235,594	$3,063,603	846,532	$11,008,081	$10.10
1946	544,529	6,842,541	160,886	2,021,696	705,415	8,864,237	9.76
1947	598,703	8,001,205	266,104	3,556,281	864,807	11,557,486	10.38
1948	529,478	7,478,271	233,099	3,292,261	762,577	10,770,532	10.97
1949	476,932	7,276,481	130,592	1,992,423	607,524	9,268,904	11.85

[1] Includes acid from foreign blende.
[2] At average of sales of 60° B. acid.

ZINC DUST

Zinc-dust production in 1949 dropped to the lowest level since 1940. Zinc powder and blue powder are not included in the Bureau of Mines production totals; the zinc dust statistically reported is restricted to commercial grades that comply with severe specifications as to percentage of unoxidized metal, evenness of grading, and fineness of

particles. The zinc content of the dust produced in 1949 ranged from 94.97 to 99.70 percent and averaged 99.5 percent. Shipments of zinc dust, which totaled 22,715 tons—2 percent of which went to foreign countries—were slightly lower than production. The quantity consumed at manufacturers' plants (3 percent of output) was greater than the difference between production and shipments, with the result that producers' stocks decreased from 1,206 tons at the beginning to 600 tons at the close of the year.

The average price of zinc dust shipped to domestic consumers in 1949 was 13.56 cents a pound compared with 15.55 cents in 1948. The raw materials used to manufacture zinc dust are reviewed in the Secondary Metals—Nonferrous chapter of this volume. Most of the production is from zinc scrap (principally galvanizers' dross), but some is recovered from zinc ore, slab zinc, and as a byproduct of zinc refining.

Zinc dust [1] produced in the United States, 1940–44 (average) and 1944–49

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per pound			Total	Average per pound
1940–44 (average)	24,093	$4,698,765	$0.098	1947	30,602	$7,589,296	$0.124
1944	26,511	5,408,244	.102	1948	32,217	10,051,704	.156
1945	25,877	5,227,154	.101	1949	22,776	6,161,756	.136
1946	28,574	6,057,688	.106				

[1] All produced by distillation.

ZINC PIGMENTS AND SALTS

The principal zinc pigments are zinc oxide and lithopone, and the principal salts are the chloride and sulfate. These products are manufactured from various zinc-bearing materials, including ore, metal, scrap, and residues. Details of the production of zinc pigments and salts are given in the Lead and Zinc Pigments and Zinc Salts chapter of this volume.

CONSUMPTION AND USES

According to reports from 610 plants, 711,841 tons of slab zinc were put in process in 1949, a 13-percent drop from the 1948 total. Receipts at consumers' plants in 1949 were 696,732 tons. A comparison of the calculated figure of slab zinc available to consumers and the actual measured consumption since 1943 indicates that coverage of the plant survey was approximately 96 percent.

Galvanizing continued to be the largest field of zinc use in 1949, although the quantity consumed was less than the record peak consumption in 1948 owing to the labor strike which occurred within the steel industry during the latter part of 1949. Zinc-base alloys, largely die castings, continued to be the second-largest use of slab zinc; but, as in galvanizing, the quantity consumed in 1949 fell short of equaling the record high established in 1948. Consumption of slab zinc for the manufacture of brass products dropped sharply compared with 1948 as a result of the abnormally large return of brass scrap to the mills, which reduced requirements for primary metals. Rolled zinc required 28 percent less slab zinc in 1949 than in 1948.

Consumption of slab zinc in the United States, 1945–49, by industries, in short tons[1]

Industry and product	1945	1946	1947	1948	1949
Galvanizing:[2]					
Sheet and strip	135,383	113,816	115,147	120,360	146,923
Wire and wire rope	46,083	43,667	49,726	49,906	39,231
Tubes and pipe	63,163	62,460	77,238	81,874	78,030
Fittings	10,014	10,593	10,467	14,037	11,487
Other	82,538	89,223	108,749	104,792	75,209
Total galvanizing	337,181	319,759	361,327	370,969	350,880
Brass products:					
Sheet, strip, and plate	146,375	66,125	50,212	51,813	43,157
Rod and wire	67,299	53,387	34,653	32,076	23,651
Tube	21,507	19,173	15,488	15,890	12,816
Castings and billets	12,942	4,776	3,155	4,228	2,620
Copper-base ingots	9,893	4,379	7,299	3,546	2,701
Other copper-base products	1,361	1,262	1,540	1,587	589
Total brass products	259,377	149,102	112,347	109,140	85,534
Zinc-base alloy:					
Die castings	121,966	206,237	210,214	230,995	199,665
Alloy dies and rod	8,286	5,313	3,802	3,171	2,024
Slush and sand castings	584	661	453	462	492
Total zinc-base alloy	130,836	212,211	214,469	234,628	202,181
Rolled zinc	97,589	92,397	70,680	76,672	55,200
Zinc oxide	18,113	19,170	18,376	15,657	10,292
Other uses:					
Wet batteries	1,790	1,635	1,462	1,368	1,359
Desilverizing lead	2,095	1,781	2,687	2,654	2,448
Light-metal alloys	1,469	545	607	1,125	1,060
Other[3]	3,861	4,642	4,405	5,522	2,887
Total other uses	9,215	8,603	9,161	10,669	7,754
Total consumption[4]	852,311	801,242	786,360	817,735	711,841

[1] Excludes some small consumers.
[2] Includes zinc used in electrogalvanizing and electroplating, but excludes sherardizing.
[3] Includes zinc used in making zinc dust, bronze powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.
[4] Includes 5,111 tons of remelt zinc in 1945, 3,912 tons in 1946, 3,577 tons in 1947, 3,141 tons in 1948, and 2,394 tons in 1949.

The quantity of slab zinc consumed for rolled products in 1949 decreased 28 percent from the 1948 figure. In addition to slab zinc, the rolling mills remelt and reroll the metallic scrap produced from their fabricating operations. The scrap so treated in 1949 amounted to 8,977 tons—a sharp drop from the 15,032 tons processed in 1948. Purchased zinc scrap in the form of zinc clippings, old zinc scrap, and engravers' plates totaling 3,802 tons were melted and rolled in 1949 (3,689 tons in 1948). Production of rolled zinc from slab zinc and purchased scrap was 57,987 tons, a decrease of 25 percent from the 1948 total. Inventories of rolled zinc were 4,123 tons on December 31, 1949, compared with 4,120 tons on the same date in 1948. In addition to the actual shipments of 42,064 tons of rolled zinc in 1949, the rolling mills processed 24,648 tons of rolled zinc (including that which was remelted and rerolled) in manufacturing 16,205 tons of semifabricated and finished products.

The following table shows the six commercial grades of refined slab zinc and purchased remelt spelter consumed by the various industries in 1949. Of the 711,841 tons of domestic and foreign zinc consumed, 45 percent was Prime Western, 33 percent Special High Grade, and 14 percent Regular High Grade, compared with 40, 33, and 16 percent, respectively, in 1948. All grades of zinc were used for galvanizing and in the manufacture of brass. Prime Western was

Rolled zinc produced and quantity available for consumption in the United States, 1948–49

	1948			1949		
	Short tons	Value		Short tons	Value	
		Total	Average per pound		Total	Average per pound
Production:						
Sheet zinc not over 0.1 inch thick	18,974	$7,952,260	$0.210	14,710	$5,642,609	$0.192
Boiler plate and sheets over 0.1 inch thick	1,344	440,543	.164	757	257,855	.170
Strip and ribbon zinc [1]	56,301	19,439,164	.173	41,354	13,691,412	.166
Foil, rod, and wire	1,050	602,710	.287	1,166	552,546	.237
Total rolled zinc	77,669	28,434,677	.183	57,987	20,144,422	.174
Imports	120	32,871	.137	32	8,144	.127
Exports	6,380	2,715,839	.213	6,147	2,858,566	.232
Available for consumption	[2] 71,293			51,869		
Value of slab zinc (all grades)			.133			.124
Value added by rolling			.050			.050

[1] Figures represent net production. In addition 15,032 tons of strip and ribbon zinc in 1948 and 8,977 tons in 1949 were rerolled from scrap originating in fabricating plants in connection with zinc rolling mills.
[2] Allowances made for change in producers' stocks of rolled zinc.

the principal grade used in the hot-dip process of galvanizing, the higher grades being used chiefly for electrogalvanizing. Rigid specifications in brass manufacture necessitate the use of high-purity metal, 78 percent of the total used in this industry being of the two highest grades.

Consumption of slab zinc in the United States in 1949, by grade and industry, in short tons

Industry	Special High Grade	Regular High Grade	Intermediate	Brass Special	Selected	Prime Western	Remelt	Total
Galvanizers	11,354	12,956	9,594	10,765	238	304,076	1,897	350,880
Brass products	21,190	45,813	2,271	6,191	1,250	8,474	345	85.534
Zinc-base alloy	195,691	6,372	19			81	18	202,181
Roller zinc	2,871	21,763	15,320	13,017		2,229		55,200
Zinc oxide	501	7,805		10		1,903	73	10,292
Other	947	2,282	861	20		3,583	61	7,754
Total	232,554	96,991	28,065	30,003	1,488	320,346	2,394	711,841

CONSUMPTION OF SLAB ZINC BY GEOGRAPHIC AREAS[3]

The geography of slab zinc consumption is available in detail only since 1940. During the 10-year period through 1949 substantial shifts are observable, largely the result of conversion to war production in 1940–41 and reconversion to peacetime consumption in 1945–46. The distribution of total slab zinc consumed for all uses according to geographic divisions and by States and for individual uses is shown in the following tables.

Consumption of Slab Zinc for All Uses.—During the period 1940–49 Illinois has ranked first among the 42 zinc-consuming States and the District of Columbia with an annual average of 132,280 short tons,

[3] This section is based partly on a detailed study by Ransome, Alfred L., Consumption of Slab Zinc in the United States by Industries, Grades, and Geographic Divisions, 1940–45: Bureau of Mines Inf. Circ. 7450, 1948, 30 pp.

Consumption of slab zinc in the United States, 1942–46 (average) and 1947–49, by geographic divisions and States

Geographic division and State	1942–46 (average)		1947		1948		1949	
	Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
I. New England:								
Connecticut	121,363	2	[1] 58,155	4	[1] 57,001	5	40,948	5
Massachusetts	14,691	14	[1] 11,211	15	[1] 10,476	15	7,454	16
Maine	979	23	93	31	78	31	67	31
New Hampshire	299	29	(2)	35	(2)	35	(2)	34
Rhode Island	137	35	(2)	26	(2)	29	(2)	30
Total	137,469	3	[1] 69,819	3	[1] 67,891	3	48,650	4
II. Middle Atlantic:								
New Jersey	22,418	11	[1] 22,944	10	[1] 20,944	12	19,084	12
New York	45,672	6	[1] 44,568	7	[1] 47,262	6	39,619	6
Pennsylvania	111,814	3	[1] 119,942	3	[1] 130,912	3	105,308	3
Total	179,904	2	[1] 187,454	2	[1] 199,118	2	164,011	2
III. South Atlantic:								
Delaware	1	40	------	------	------	------	------	------
District of Columbia	187	32	(2)	34	(2)	33	21	32
Florida	170	33	------	------	------	------	------	------
Georgia	1,274	22	2,750	19	2,738	19	1,703	20
Maryland	24,066	10	[1] 23,024	9	24,966	9	26,525	9
South Carolina	159	34	(2)	32	(2)	32	------	------
Virginia	633	26	[1] 230	28	(2)	28	267	27
West Virginia	19,586	12	[1] 21,636	11	[1] 23,781	10	25,694	11
Total	46,076	4	[1] 47,700	4	[1] 51,939	4	54,210	3
IV. East North Central:								
Illinois	131,054	1	[1] 139,844	1	[1] 152,050	1	131,619	1
Indiana	64,767	5	[1] 56,903	5	[1] 61,356	4	52,837	4
Michigan	45,476	7	[1] 45,373	6	[1] 41,887	7	32,265	7
Ohio	107,003	4	[1] 134,702	2	[1] 132,044	2	123,903	2
Wisconsin	28,558	8	[1] 12,655	14	[1] 11,988	14	9,152	15
Total	376,858	1	[1] 389,477	1	[1] 399,325	1	349,776	1
V. East South Central:								
Alabama	15,390	13	17,048	12	22,030	11	26,383	10
Kentucky	5,711	17	7,893	16	9,014	16	9,781	14
Tennessee	750	25	1,718	21	1,242	23	860	25
Total	21,851	6	26,659	7	32,286	5	37,024	5
VI. West North Central:								
Iowa	5,978	16	7,258	17	7,409	17	4,600	17
Kansas	84	36	33	33	22	34	19	33
Minnesota	2,353	19	[1] 3,536	18	[1] 4,062	18	2,970	18
Missouri	11,582	15	[1] 16,252	13	[1] 17,569	13	13,166	13
Nebraska	810	24	[1] 1,641	23	1,551	22	1,587	21
Total	20,807	7	[1] 28,720	5	[1] 30,613	6	22,342	7
VII. West South Central:								
Louisiana	283	30	(2)	30	(2)	30	(2)	29
Oklahoma	543	28	(2)	25	(2)	24	(2)	24
Texas	2,402	18	2,134	20	1,726	21	1,836	19
Total	3,228	8	3,060	8	2,900	8	3,014	8
VIII. Mountain:								
Arizona	19	39	------	------	------	------	------	------
Colorado	1,283	21	[1] 1,644	22	[1] 1,824	20	(2)	22
Idaho	246	31	(2)	29	(2)	26	(2)	26
Nevada	54	37	------	------	------	------	------	------
Utah	37	38	(2)	36	(2)	36	(2)	35
Total	1,639	9	[1] 1,871	9	[1] 2,312	9	1,851	9
IX. Pacific:								
California	24,191	9	[1] 26,555	8	[1] 26,946	8	27,305	8
Oregon	577	27	339	27	361	27	245	28
Washington	1,624	20	1,129	24	903	25	1,019	23
Total	26,392	5	[1] 28,023	6	[1] 28,210	7	28,569	6
Grand total [3]	814,224	------	[1] 782,783	------	[1] 814,594	------	709,447	------

[1] Revised figure.
[2] Nominal quantity consumed included with subtotal for division, as less than 3 companies reported.
[3] Excludes remelt zinc.

Since 1945 Ohio has been in second place. Connecticut, which averaged second during the war period owing to the large quantities of zinc consumed in the brass plants of that State, has since dropped to fifth place. Since 1940 Pennsylvania has held either second or third place. The greatest concentration of slab-zinc consumption is in the region comprising Illinois, Indiana, Michigan, Ohio, and Wisconsin. This area, which has consistently ranked first in zinc consumption since 1940, uses nearly half the total quantity of slab zinc consumed annually in the United States. The region of least consumption is the Mountain States, including Arizona, Colorado, Idaho, Nevada, New Mexico, and Utah, which has accounted for less than 0.3 percent of the total.

Consumption of Slab Zinc for Galvanizing.—The iron and steel industry is the largest consumer of slab zinc, which it uses for galvanizing or rustproofing sheets, wire, tubes and pipes, building and pole-line hardware, railway-signal equipment, chains, bolts, screws, and a multitude of other items. It is, therefore, quite understandable that the principal iron- and steel-producing States are also the principal consumers of zinc for galvanizing. From 1940 through 1943, Pennsylvania ranked first among the 34 States that consumed zinc for this purpose. In 1944 Ohio displaced Pennsylvania and re-

Consumption of slab zinc for galvanizing in the United States, 1942–46 (average) and 1947–49, by States

State	Geographic division	1942–46 (average)		1947		1948		1949	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	15,298	7	(1)	7	(1)	7	25,918	5
California	IX	12,526	8	17,016	8	15,046	8	13,493	8
Colorado	VIII	1,236	19	(1)	20	(1)	19	(1)	20
Connecticut	I	3,645	14	3,405	16	3,752	15	1,843	16
Florida	III	169	29	-----	-----	-----	-----	-----	-----
Georgia	III	1,271	18	(1)	18	(1)	17	(1)	18
Illinois	IV	29,633	3	44,087	3	47,660	3	43,430	3
Indiana	IV	20,574	4	27,018	4	26,458	4	25,113	6
Iowa	VI	177	28	(1)	31	(1)	31	(1)	30
Kentucky	V	5,681	11	(1)	9	(1)	9	(1)	9
Louisiana	VII	275	27	(1)	27	(1)	28	(1)	26
Maine	I	870	22	(1)	29	(1)	29	(1)	29
Maryland	III	16,018	6	22,464	5	24,422	5	26,196	4
Massachusetts	I	6,768	10	6,769	11	6,065	10	4,188	12
Michigan	IV	4,542	13	4,045	14	3,513	16	2,598	15
Minnesota	VI	2,349	17	(1)	15	4,062	14	(1)	14
Missouri	VI	3,361	15	(1)	13	4,483	13	3,472	13
Nebraska	VI	150	30	(1)	24	(1)	27	(1)	27
New Hampshire	I	73	33	-----	-----	-----	-----	-----	-----
New Jersey	II	7,142	9	5,012	12	5,104	12	4,608	10
New York	II	5,335	12	7,395	10	5,906	11	4,382	11
Ohio	IV	65,234	2	82,679	1	82,622	1	78,663	1
Oklahoma	VII	527	25	(1)	23	(1)	21	(1)	21
Oregon	IX	561	24	(1)	26	(1)	24	(1)	25
Pennsylvania	II	65,388	1	71,013	2	73,806	2	67,230	2
Rhode Island	I	125	31	(1)	25	(1)	25	(1)	28
South Carolina	III	122	32	(1)	30	(1)	30	-----	-----
Tennessee	V	590	23	(1)	21	(1)	22	(1)	23
Texas	VII	1,233	20	2,069	19	(1)	20	(1)	19
Utah	VIII	33	34	-----	-----	-----	-----	(1)	24
Virginia	III	502	26	(1)	28	(1)	26	-----	-----
Washington	IX	1,142	21	1,095	22	(1)	23	(1)	22
West Virginia	III	17,792	5	(1)	6	(1)	6	(1)	7
Wisconsin	IV	2,396	16	2,953	17	2,560	18	1,806	17
Total [2]	-----	292,738	-----	358,533	-----	368,796	-----	348,983	-----

[1] Bureau of Mines not at liberty to publish figure.
[2] Excludes remelt zinc.

tained the top position in the succeeding years through 1949. The greatest concentration of zinc consumption for galvanizing is the region comprising Illinois, Indiana, Pennsylvania, and Ohio, which accounted for 62 percent of the average annual domestic consumption for this use in the period 1940–45. In 1946, total zinc used for galvanizing in these States rose to 65 percent but declined to 63 percent in 1947 and 1948 and 61 percent in 1949.

Consumption of Slab Zinc for Brass Products.—From 1940 through 1949 Connecticut has ranked first among the States consuming slab zinc for brass products; but, owing to the wartime demand for brass and the construction of new plant facilities, there has been some change in the rank of the other leading States. In 1940 Michigan was in second place, followed by New York, Illinois, Ohio, and Pennsylvania among the top six, whereas in 1949 Illinois ranked second, with Michigan in third place, followed by New York, Ohio, and Wisconsin.

Consumption of slab zinc for brass products in the United States, 1942–46 (average) and 1947–49, by States

State	Geographic division	1942–46 (average)		1947		1948		1949	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	91	17	(1)	19	(1)	13	(1)	13
California	IX	2,320	12	665	11	718	11	643	11
Colorado	VIII	34	22	(1)	14	(1)	16	(1)	15
Connecticut	I	112,863	1	47,903	1	46,671	1	34,615	1
Delaware	III	1	32						
District of Columbia	III	187	16	(1)	17	(1)	15	(1)	16
Florida	III	1	33						
Georgia	III	3	28	(1)	21	(1)	22	(1)	23
Illinois	IV	32,697	2	11,712	3	13,228	2	12,297	2
Indiana	IV	15,862	7	1,835	10	2,217	10	2,222	9
Iowa	VI	2	30	(1)	25	(1)	27		
Kansas	VI	48	20	(1)	29	(1)	19	(1)	20
Kentucky	V	24	23	(1)	24	(1)	23	(1)	24
Maine	I	72	18	(1)	27			(1)	26
Maryland	III	7,990	10	(1)	12	544	12	329	12
Massachusetts	I	6,495	11	2,797	9	2,734	9	2,100	10
Michigan	IV	30,647	3	12,104	2	10,333	3	8,542	3
Minnesota	VI	3	29						
Missouri	VI	345	14	99	13	136	14	(1)	14
Nebraska	VI	7	27	(1)	22	(1)	26	(1)	25
New Hampshire	I	217	15	(1)	18	(1)	20	(1)	17
New Jersey	II	9,972	9	7,617	5	5,643	7	3,481	8
New York	II	23,432	6	7,320	6	7,838	4	6,805	4
Ohio	IV	23,585	5	7,901	4	7,059	5	5,712	5
Oregon	IX	16	24	(1)	26	(1)	24	(1)	21
Pennsylvania	II	13,282	8	4,825	8	4,610	8	3,485	7
Rhode Island	I	12	25	(1)	23	(1)	21	(1)	22
South Carolina	III	37	21			(1)	28		
Texas	VII	11	26	23	15	(1)	17	(1)	18
Utah	VIII	2	31	(1)	28				
Virginia	III	68	19	(1)	16	(1)	18	(1)	19
Washington	IX	474	13			(1)	26		
Wisconsin	IV	24,442	4	(1)	7	6,278	6	4,441	6
Total [2]		305,242		111,997		108,429		85,189	

[1] Bureau of Mines not at liberty to publish figure.
[2] Excludes remelt zinc.

Consumption of Slab Zinc for Zinc-Base Alloys.—The automobile industry is the largest user of zinc-base alloys, principally for die-cast parts and assemblies, such as fuel pumps, carburetors, radiator grilles, windshield wipers, and a wide variety of both interior and exterior hardware. Thus the region embracing Illinois, Indiana,

Michigan, Ohio, and Wisconsin, in which the automobile industry is centered, is the area of greatest concentration of slab zinc consumed for zinc-base alloys. Nearly 62 percent of the zinc used for die castings and other zinc-base alloys in 1949 was consumed in this region.

Consumption of slab zinc for zinc-base alloys in the United States, 1942–46 (average) and 1947–49, by States

State	Geographic division	1942–46 (average)		1947		1948		1949	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
California	IX	8,822	6	8,352	9	10,775	8	12,901	7
Connecticut	I	2,727	10	[1]	10	[1]	10	3,466	10
Florida	III	1	18						
Illinois	IV	31,578	1	44,231	1	54,602	1	48,772	1
Indiana	IV	7,199	8	13,369	6	14,958	6	13,082	6
Kansas	VI	29	14						
Maine	I	13	17						
Maryland	III	58	13						
Massachusetts	I	28	15	[1]	14	[1]	14		
Michigan	IV	9,850	5	[1]	3	[1]	4	[1]	4
Missouri	VI	7,647	7	11,572	7	12,724	7	[1]	9
New Jersey	II	3,262	9	8,471	8	8,266	9	9,324	8
New York	II	13,654	3	25,135	4	28,312	3	23,220	3
Ohio	IV	17,454	2	43,851	2	42,092	2	39,292	2
Oklahoma	VII	16	16						
Pennsylvania	II	11,624	4	21,131	5	26,429	5	18,601	5
Texas	VII	1,051	12	[1]	12	[1]	12	[1]	12
Virginia	III			[1]	15	[1]	13	[1]	13
Washington	IX	1	19	34	13				
Wisconsin	IV	1,709	11	3,221	11	[1]	11	[1]	11
Total [2]		116,723		214,434		234,612		202,163	

[1] Bureau of Mines not at liberty to publish figure.
[2] Excludes remelt zinc.

Consumption of Slab Zinc for Rolled Zinc.—During the period 1940–49, although the quantity of slab zinc consumed for rolled zinc changed widely, the geographic pattern and rank of the consuming States varied but little. Illinois and Indiana ranked first and second, respectively, and accounted for the greater quantity of slab zinc consumed for rolling in the United States. Pennsylvania held third place through 1946 but was displaced in 1947 and 1948 by Iowa, which moved up from fourth position. In 1949 New York ranked third, with Iowa and Pennsylvania in fourth and fifth places, respectively.

Consumption of slab zinc for rolled zinc in the United States, 1942–46 (average) and 1947–49, by States

State	Geographic division	1942–46 (average)		1947		1948		1949	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Connecticut	I	1,790	6	[1]	7	[1]	8	[1]	7
Illinois	IV	35,857	1	[1]	1	35,964	1	26,538	1
Indiana	IV	19,469	2	[1]	2	[1]	2	[1]	2
Iowa	VI	5,799	4	[1]	3	[1]	3	[1]	4
Massachusetts	I	1,349	8	[1]	6	[1]	7	[1]	6
New York	II	2,849	5	[1]	5	[1]	5	[1]	3
Pennsylvania	II	7,318	3	[1]	4	[1]	4	[1]	5
West Virginia	III	1,770	7	[1]	8	[1]	6	[1]	8
Total		76,201		70,680		76,672		55,266	

[1] Bureau of Mines not at liberty to publish figure.

Consumption of Slab Zinc for Zinc Oxide.—Because of the small number of companies consuming slab zinc in the manufacture of zinc oxide and because individual company figures could not be disclosed, it was impossible to prepare a table showing specific quantities consumed. A table is included, however, to show the relative rank of each State and the totals for each year.

Consumption of slab zinc for zinc oxide in the United States, 1942–46 (average) and 1947–49, by States

State	Geographic division	1942–46 (average)		1947		1948		1949	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Illinois	IV	1,216	3	(1)	2	(1)	2	(1)	2
Indiana	IV	1,344	2	(1)	3	(1)	3	(1)	3
Pennsylvania	II	12,560	1	(1)	1	(1)	1	(1)	1
Total	------	15,120	------	18,376	------	15,657	------	10,219	------

[1] Bureau of Mines not at liberty to publish figure.

Consumption of Slab Zinc for Other Uses.—The distribution by States of the quantity of zinc consumed for such purposes as slush castings, wet batteries, desilverizing lead, light-metal alloys (other than zinc-base alloys), zinc dust, sundry chemicals, and bronze powder is shown in the following table:

Consumption of slab zinc for other uses in the United States, 1942–46 (average) and 1947–49, by States

State	Geographic division	1942–46 (average)		1947		1948		1949	
		Short tons	Rank	Short tons	Rank	Short tons	Rank	Short tons	Rank
Alabama	V	------	------	------	------	------	------	(1)	12
Arizona	VIII	19	20	------	------	------	------	------	------
California	IX	524	5	522	4	407	6	268	7
Colorado	VIII	13	21	(1)	18	(1)	20	------	------
Connecticut	I	337	8	41	12	(1)	7	(1)	10
Idaho	VIII	246	10	(1)	9	(1)	5	(1)	5
Illinois	IV	72	14	(1)	10	(1)	13	(1)	14
Indiana	IV	319	9	(1)	11	(1)	14	46	15
Iowa	VI	------	------	------	------	------	------	(1)	16
Kansas	VI	7	25	(1)	16	(1)	16	(1)	18
Kentucky	V	6	27	------	------	------	------	------	------
Louisiana	VII	9	24	------	------	------	------	------	------
Maine	I	24	19	------	------	------	------	------	------
Massachusetts	I	51	17	(1)	13	(1)	15	(1)	17
Michigan	IV	437	6	(1)	14	(1)	12	(1)	13
Minnesota	VI	1	29	(1)	19	------	------	(1)	21
Missouri	VI	229	11	416	5	226	10	332	6
Nebraska	VI	653	4	(1)	3	(1)	3	(1)	3
Nevada	VIII	54	16	------	------	------	------	------	------
New Hampshire	I	10	23	------	------	------	------	------	------
New Jersey	II	2,043	1	1,844	2	1,931	2	1,671	2
New York	II	402	7	(1)	6	(1)	4	468	4
Ohio	IV	729	3	271	7	271	8	236	8
Pennsylvania	II	1,641	2	(1)	1	(1)	1	(1)	1
Tennessee	V	160	12	(1)	8	(1)	9	(1)	11
Texas	VII	107	13	------	------	(1)	18	------	------
Utah	VIII	2	28	(1)	17	(1)	17	(1)	19
Virginia	III	63	15	(1)	20	(1)	19	(1)	20
Washington	IX	7	26	------	------	(1)	11	(1)	9
West Virginia	III	24	18	(1)	15	------	------	------	------
Wisconsin	IV	11	22	------	------	------	------	------	------
Total [2]	------	8,209	------	8,763	------	10,428	------	7,693	------

[1] Bureau of Mines not at liberty to publish figure.
[2] Excludes remelt zinc.

STOCKS

Producers' Stocks.—Inventories of slab zinc at producers' plants were 94,221 tons on December 31, more than 4½ times larger than stocks on hand at the beginning of the year. The peak of the year was reached on October 31, when stocks totaled 97,666 tons.

Stocks of zinc at zinc-reduction plants in the United States at end of year, 1945–49, in short tons

	1945	1946	1947	1948	1949
At primary reduction plants	254,692	175,513	67,046	19,179	90,787
At secondary distilling plants	1,451	756	1,601	1,669	3,434
Total	256,143	176,269	68,647	20,848	94,221

Consumers' Stocks.—On December 31, 1949, consumers' stocks of slab zinc were 80,889 short tons, a decrease of 16 percent from the beginning of the year. At the average monthly rate of consumption in 1949, consumers' stocks on hand December 31 were approximately 1⅓ months' requirements.

Consumers' stocks of slab zinc at plants at the beginning and end of 1949, by industries, in short tons

Date	Galvanizers	Brass mills [1]	Die casters [2]	Zinc rolling mills	Oxide plants	Others	Total
Dec. 31, 1948	[3] 45,627	[3] 18,427	[3] 24,274	5,983	258	[3] 1,315	[3][4] 95,884
Dec. 31, 1949	44,910	10,529	18,583	5,039	803	1,025	[4] 80,889

[1] Includes brass mills, brass ingot makers, and brass products.
[2] Includes producers of zinc-base die castings, zinc-alloy dies, and zinc-alloy rods.
[3] Revised figure.
[4] Stocks on Dec. 31, 1948 and 1949, exclude 312 (revised figure) and 198 tons, respectively, of remelt spelter.

PRICES

The market price for Prime Western grade slab zinc, St. Louis, was quoted at 17.50 cents per pound until March 23, when it dropped to 16 cents. A series of price reductions followed until June 15, when the quotation was 9 cents, where it remained for a month. On July 18 the price increased to 9.50 cents and 1 week later to 10 cents. The remainder of the year the quotation fluctuated from 9.25 to 9.75 cents. One producer quoted its price at 10 cents, but most sales were at 9.75 cents at the close of 1949.

The British Ministry of Supply price for foreign zinc per long ton delivered to consumers, duty paid, was £106 per long ton (equivalent to 19.05 cents a pound) at the beginning of the year. On April 4 it was reduced to £101 (18.15 cents), and on May 16, June 10, and July 12 further reductions to £85 (15.27 cents), £78 (14.02 cents), and £58 (10.42 cents), respectively, took place. It was raised on July 20 to £60 15s. (10.92 cents) and on July 26 to £63 10s. (11.41 cents), where it remained until September. Another rise on September 5 established the quotation at £66 5s. (11.90 cents). On September 10 the price dropped to £63 10s. (11.41 cents), where it remained until mid-September, when quotations were suspended. Due to the de-

Price of zinc concentrates and zinc, 1945–49

	1945	1946	1947	1948	1949
Joplin 60-percent zinc concentrates:					
Price per short ton......dollars..	55.28	51.12	66.20	86.37	72.28
Average price common zinc at—					
St. Louis (spot)......cents per pound..	8.25	8.73	10.50	13.58	12.15
New York......do....	8.65	9.15	11.01	14.21	12.86
London [1]......do....	5.18	7.75	12.58	14.38	14.41
Price indexes (1925–29 average=100):					
Zinc (New York)......	122	128	155	200	181
Lead (New York)......	87	109	196	241	206
Copper (New York)......	80	93	143	150	131
Nonferrous metals [2]......	87	100	142	159	146
All commodities [2]......	108	121	155	168	158

[1] Conversion of English quotations into American money based on average rates of exchange recorded by Federal Reserve Board.
[2] Based upon price indexes of U. S. Department of Labor.

Average monthly quoted prices of 60-percent zinc concentrates at Joplin, and of common zinc (prompt delivery or spot) St. Louis and London, 1948–49 [1]

Month	1948			1949		
	60-percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (cents per pound)		60-percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (cents per pound)	
		St. Louis	London [2]		St. Louis	London [2]
January......	73.88	11.08	12.58	110.00	17.50	19.05
February......	78.00	12.00	13.48	110.00	17.50	19.05
March......	78.00	12.00	13.48	108.61	17.06	19.05
April......	78.00	12.00	13.48	91.79	14.06	18.22
May......	78.00	12.00	13.48	75.83	11.88	16.60
June......	78.00	12.00	13.48	56.63	9.55	14.40
July......	82.08	12.46	13.48	51.00	9.36	11.95
August......	95.00	15.00	13.48	57.00	10.00	11.41
September......	95.00	15.00	13.48	57.69	10.05	11.34
October......	96.38	15.19	16.53	52.54	9.32	10.39
November......	104.46	16.67	16.53	55.62	9.77	10.78
December......	116.60	17.50	19.05	55.30	9.77	10.71
Average for year......	86.37	13.58	14.38	72.28	12.15	14.41

[1] Joplin: Metal Statistics, 1950, p. 566. St. Louis: Metal Statistics, 1950, p. 562. London: E&MJ Metal and Mineral Markets.
[2] Conversion of English quotations into American money based on average rates of exchange recorded by Federal Reserve Board.

Average price received by producers of zinc, 1945–49, by grades, in cents per pound [1]

	1945	1946	1947	1948	1949
Grade A:					
Special High Grade......	8.89	9.18	11.10	13.72	12.76
Regular High Grade......	8.60	8.81	10.76	13.40	12.29
Grade B: Intermediate......	8.66	9.08	11.19	13.49	12.94
Grades C and D:					
Brass Special......	8.48	9.00	10.67	13.33	12.75
Selected......	8.32	8.89	10.26	13.05	12.87
Grade E: Prime Western......	8.24	8.60	10.39	12.93	12.18
All grades......	8.6	8.88	10.71	13.32	12.42
Prime Western; spot quotation at St. Louis......	8.25	8.73	10.50	13.58	12.15

[1] Does not include overquota premium payments made by Office of Metals Reserve in 1945–47.

valuation of the British pound on September 19, the quoted price as announced on September 21 was £87 10s. (equivalent to 10.94 cents a pound at the new $2.80 base). On October 8 a further reduction to £81 10s (10.19 cents) was announced, followed by three successive increases to £83 10s. (10.44 cents), £85 10s. (10.69 cents), and £87 10s. (10.94 cents) on October 28, November 3, and November 10, respectively. On November 23 the price was lowered to £85 10s. (10.69 cents), where it remained until December 30, when it was raised to £87 10s. (10.94 cents).

At the beginning of 1949 the Australian price per long ton, f. o. b., Risdon, Tasmania, for zinc for consumption was raised to £A40.

FOREIGN TRADE [3]

Imports.—Total imports of zinc in ores and concentrates in 1949 declined 9 percent from 1948. Of the 240,881 tons of contained zinc imported, 60 percent came from Mexico, 25 percent from Canada, 6 percent from Peru, 3 percent from Union of South Africa, 2 percent each from Australia and Spain, 1 percent from Bolivia, and the remaining 1 percent from Colombia, Costa Rica, Cuba, El Salvador, Honduras, Korea, and Saudi Arabia.

Slab-zinc imports totaled 126,925 tons and were 36 percent higher than the quantity imported in 1948. Canada supplied 86 percent of the total, Mexico 11 percent, and Belgium-Luxembourg 2 percent; Norway, Australia, Burma, Japan, and the Philippine Republic together accounted for the remaining 1 percent.

Zinc imported for consumption in the United States, 1945–49, by classes

[U. S. Department of Commerce]

Year	Ores (zinc content)		Blocks, pigs, slabs		Sheets		Old, dross, and skimmings [1]		Zinc dust		Total value [2]
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1945	331,533	$15,021,771	96,760	$12,173,525	(3)	$2	7,299	$476,920	362	$39,789	$27,712,007
1946	166,885	8,122,471	[4] 104,065	[4] 16,481,904	(3)	10	[4] 4,087	[4] 293,375	77	4,942	24,902,702
1947	194,822	12,165,163	72,063	14,822,407	1	457	5,105	439,511	------	------	27,427,538
1948	133,814	11,737,624	[4] 92,495	[4] 24,911,454	120	32,871	10,273	1,181,495	41	5,370	[4] 37,868,814
1949	109,535	11,748,199	125,564	29,340,620	32	8,144	3,732	558,702	17	4,397	41,560,062

[1] Includes dross and skimmings as follows—1945: 4,291 tons, $230,973; 1946: Revised figure, 2,801 tons, $181,918; 1947: 4,391 tons, $353,415; 1948: 8,637 tons $873,099; 1949: 2,668 tons, $335,283.

[2] In addition, manufactures of zinc imported as follows—1945: $8,077· 1946: $1,929; 1947: $4,429; 1948: $16,056; 1949: $2,583.

[3] Less than 1 ton.

[4] Revised figure.

Exports.—The value of exports of zinc ores, concentrates, and manufactured articles containing zinc of foreign and domestic origin (excluding galvanized products, alloys, and pigments) amounted to $23,159,259 in 1949, compared with $19,865,037 (revised figure) in 1948. In addition to the items shown in the accompanying tables, considerable zinc is exported each year in brass, pigments, chemicals, and galvanized iron and steel. Export data on zinc pigments and chemicals are given in the Lead and Zinc Pigments and Zinc Salts chapter of this volume.

[3] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Zinc imported into the United States, in ores, blocks, pigs, or slabs, by countries, 1947–49,[1] in short tons[2]

[U. S. Department of Commerce]

Country	1947	1948	1949
Ores (zinc content):			
Argentina	----------	77	----------
Australia	864	495	4,956
Bolivia	17,176	4,515	3,526
Canada	42,430	[3] 55,371	61,314
Newfoundland-Labrador	8,873	9,753	----------
Italy	11,613	11,288	----------
Japan	----------	5,018	----------
Korea	----------	1,902	168
Mexico	163,726	142,134	143,803
Peru	49,952	22,475	14,901
Spain	3,321	9,101	4,880
Union of South Africa	4	2,035	6,568
Other countries	----------	39	765
Total ores	297,959	[3] 264,203	240,881
Blocks, pigs, or slabs:			
Australia	3	75	103
Belgium-Luxembourg	----------	1,145	1,933
Canada	54,954	[3] 77,660	109,708
Italy	----------	1,579	----------
Japan	16,927	4,686	1
Mexico	332	5,737	14,191
Norway	----------	2,240	960
Other countries	96	110	29
Total blocks, pigs, or slabs	72,312	[3] 93,232	126,925

[1] Changes in Minerals Yearbook, 1948, p. 1307; 1946 data should read as follows: Ore—Bolivia, 28,442 tons; Mexico, 119,113 tons; Peru, 48,832 tons; total, 265,760 tons. Blocks, pigs, or slabs—Canada, 85,244 tons; total, 104,793 tons.
[2] Data include zinc imported for immediate consumption plus material entering country under bond.
[3] Revised figure.

Slab zinc was exported in 1949 to 32 foreign countries, representing shipments to every continent except Australia. United Kingdom was the destination of nearly 39 percent of the 58,709 short tons of slab zinc exported during the year. Over 21 percent was shipped to India, France received 8, and Germany and Netherlands received 7 percent each.

Zinc ore and manufactures of zinc, exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Zinc ore, concentrates, and dross (zinc content)		Slabs, pigs, or blocks		Sheets, plates, strips, or other forms, n. e. s.		Zinc scrap (zinc content)		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	(1)	$67	7,782	$1,126,910	6,235	$1,747,937	(2)	(2)	380	$81,308
1946	89	15,440	47,224	8,222,940	13,846	4,468,328	(2)	(2)	366	89,439
1947	1,404	215,123	106,669	22,817,004	10,898	4,234,306	(2)	(2)	1,646	448,407
1948	3,547	422,314	[3] 65,537	[3] 15,852,819	7,344	3,290,410	(2)	(2)	891	299,494
1949	2,925	477,718	58,709	18,699,597	7,456	3,496,169	1,570	$224,291	690	261,484

[1] Less than 1 ton.
[2] Not separately classified before Jan. 1, 1949; formerly included with "Other forms, n. e. s."
[3] Revised figure.

Slab and sheet zinc exported from the United States, by destinations, 1946–49, in short tons

[U. S. Department of Commerce]

Destination	Slabs, pigs, and blocks				Sheets, plates, strips, or other forms, n. e. s.			
	1946	1947	1948	1949	1946	1947	1948	1949
Country:								
Argentina	3,811	5,809	[1] 741	-------	1,353	890	478	-------
Austria	-------	-------	213	1,172	-------	-------	1	9
Belgium-Luxembourg	4,601	7,971	5,132	1,081	5	13	17	19
Brazil	1,301	1,735	1,279	2,286	1,256	628	106	85
Canada	1	3	504	10	2,975	2,579	3,584	2,958
Chile	687	600	980	425	322	291	152	90
China	1,667	611	44	30	757	431	106	12
Colombia	32	-------	3	40	53	143	134	214
Cuba	67	182	303	116	70	91	103	71
Czechoslovakia	1,118	3,347	-------			726	-------	-------
Denmark	-------	-------	-------	2,794	19	-------	-------	-------
Finland	950	2,330	-------	112	9	19	-------	3
France	(2)	5,253	2,205	4,840	7	-------	6	(2)
Germany	-------	392	3,473	4,293	-------	-------	-------	49
India and Pakistan	7,898	10,748	11,550	12,608	324	753	548	1,743
Indonesia	1	-------	1	2	12	146	242	50
Italy	-------	903	112	319	-------	-------	-------	-------
Malaya	-------	-------	-------	-------	1	7	137	375
Mexico	54	54	61	131	460	628	568	776
Netherlands	2,491	2,509	280	4,028	72	398	74	230
Portugal	2	269	-------	-------	520	339	243	-------
Sweden	1,293	2,454	-------	-------	537	379	8	25
Switzerland	4,205	1,492	1,273	1,432	956	241	38	99
Tunisia	-------	-------	-------	-------	74	119	-------	-------
Turkey	213	333	6	-------	2,388	210	22	2
Union of South Africa	-------	-------	-------	-------	38	93	80	76
United Kingdom	16,628	59,289	37,269	22,811	46	95	109	40
Other countries	204	385	108	179	1,592	1,679	588	530
Total	47,224	106,669	[1] 65,537	58,709	13,846	10,898	7,344	7,456
Continent:								
North America	136	262	872	267	3,603	3,441	4,374	3,858
South America	5,902	8,153	[1] 3,034	2,760	3,254	2,194	1,032	505
Europe	31,405	86,561	49,969	42,994	2,345	2,333	577	515
Asia	9,781	11,693	11,662	12,687	3,919	2,131	1,266	2,465
Africa	(2)	-------	-------	1	724	446	94	104
Oceania	-------	-------	-------	-------	1	353	1	9

[1] Revised figure.
[2] Less than 1 ton.

Tariff.—Import duties on zinc-bearing ores in 1949 remained at three-quarters cent per pound (zinc content) and on zinc in blocks, pigs, slabs, and dust at seven-eighths cent per pound.

WORLD PRODUCTION

World mine and smelter production of zinc in recent years, insofar as data are available, are shown in the following tables.

World mine production of recoverable zinc, by countries, 1943–49, in metric tons [1]

Country	1943	1944	1945	1946	1947	1948	1949
Algeria	2,680	910	1,720	3,470	5,980	4,860	6,440
Argentina	17,290	17,010	11,820	13,250	14,610	10,970	9,830
Australia	144,175	136,800	117,571	136,531	145,422	151,681	153,000
Austria	(2)	(2)	1,800	550	1,090	1,920	2,420
Belgian Congo	18,371	13,960	22,530	32,660	36,900	41,880	51,130
Bolivia	15,900	14,690	18,880	17,270	13,145	21,124	14,197
Canada	277,033	249,850	234,604	213,470	188,570	212,430	263,710
Newfoundland	54,210	48,580	46,290	44,500	36,090	35,350	
Czechoslovakia	----	----	90	270	----	----	----
Finland	6,570	6,390	5,130	5,580	6,930	(3)	(3)
France	2,340	2,250	2,970	4,320	5,220	4,633	9,870
French Equatorial Africa	610	450	500	----	----	----	40
French Indochina	4,410	1,260	360	----	----	----	----
French Morocco	450	1,170	810	1,440	1,620	1,910	2,615
Germany [4]	[2] 238,552	(3)	(3)	19,990	20,010	25,410	52,040
Greece	(3)	(3)	(3)	345	1,259	1,400	1,695
Italy	36,492	15,923	7,346	19,682	41,762	67,328	61,734
Japan	81,633	66,750	20,400	18,932	26,560	30,070	39,880
Korea	2,430	1,890	(3)	(3)	[5] 720	[5] 180	(3)
Mexico	185,930	182,590	200,380	160,730	163,840	154,340	172,320
Northern Rhodesia [6]	13,620	14,712	15,485	17,466	21,479	22,526	23,217
Norway	4,644	4,812	1,744	4,096	5,356	6,006	6,293
Peru	30,834	51,368	55,007	48,041	52,333	52,927	64,283
Poland [6]	(3)	(3)	36,385	56,614	71,756	87,089	(3)
Rumania	----	----	----	----	1,980	----	----
Spain	37,050	30,190	27,091	33,946	36,557	42,350	44,860
Sweden	28,256	29,600	30,222	34,019	32,314	31,918	31,624
Tunisia	133	667	690	1,397	2,432	1,851	2,969
U. S. S. R. [6] [7]	90,000	60,000	70,000	90,000	106,000	110,000	110,000
United Kingdom	4,140	7,920	3,420	(3)	(3)	(3)	(3)
United States	675,123	651,941	557,336	521,480	578,428	571,506	538,145
Yugoslavia	(3)	(3)	6,930	20,160	31,500	(3)	(3)
Total	2,018,000	1,709,000	1,510,000	1,523,000	1,651,000	1,725,000	1,770,000

[1] Data derived from the United Nations Statistical Yearbook, Year Book of the American Bureau of Metal Statistics, and other sources.
[2] Figure for Austria included with Germany.
[3] Data not available; estimate by author of chapter included in total.
[4] 1946–48, Bizonal area only; 1949, Federal Republic of Germany.
[5] South Korea only.
[6] Smelter production.
[7] Estimated.

World smelter production of zinc, by countries,[1] 1943–49, in metric tons

[Compiled by Berenice B. Mitchell]

Country [1]	1943	1944	1945	1946	1947	1948	1949
Argentina	658	976	983	1,814	2,631	1,602	2,648
Australia	76,972	79,979	85,118	77,541	70,535	82,617	82,255
Belgium	27,770	8,660	11,712	79,325	133,011	153,928	176,565
Canada	187,342	152,876	166,302	168,448	161,367	178,329	187,588
China	500	331	328	---	320	330	(2)
Czechoslovakia	(3)	(3)	3,300	(2)	1,964	(2)	(2)
France	21,490	8,793	8,414	31,014	46,007	55,514	60,597
French Indochina	4,138	[4] 622	---	---	---	---	---
Germany:[3]							
Federal Republic	312,000	259,600	(2)	[5, 6] 14,855	[5, 6] 20,723	[5, 6] 41,352	[6] 86,916
Soviet Zone				(2)	(2)	(2)	(2)
Italy	25,152	6,100	1,517	15,706	22,849	26,397	26,612
Japan	[7] 60,948	[7] 62,673	[7] 18,553	11,253	14,849	21,200	32,318
Mexico	54,449	49,248	48,985	41,982	56,749	48,323	53,496
Netherlands	4,565	2,105	---	2,011	9,532	13,588	15,614
Northern Rhodesia	13,620	14,712	15,485	17,466	21,479	22,526	23,217
Norway	15,376	11,777	9,228	30,210	34,580	42,000	41,040
Peru	1,225	1,447	1,583	936	1,013	1,464	1,261
Poland	(3)	(3)	36,385	56,614	71,756	87,089	(2)
Spain	19,200	18,054	17,310	17,568	19,825	21,203	19,551
Sweden	---	1,790	2,929	---	---	---	---
U. S. S. R.	(2)	(2)	(2)	(2)	[8] 106,000	(2)	(2)
United Kingdom	70,498	72,192	63,024	66,569	69,392	73,138	65,124
United States	854,844	788,613	693,594	660,665	728,007	714,644	739,154
Total (estimate) [1]	1,840,000	1,625,200	1,274,000	1,405,800	1,595,700	1,692,000	1,810,000

[1] In addition to the countries listed, Rumania and Yugoslavia produce zinc, but no estimates for them are included in the totals. Rumania produced about 2,300 metric tons in 1947, and Yugoslavia about 5,000 tons annually prewar.
[2] Data not available; estimate by senior author of chapter included in total.
[3] Data for Austria, Czechoslovakia, and Poland in 1943–44 included with Germany.
[4] Estimated.
[5] American and British zones only.
[6] Includes production from reclaimed scrap.
[7] Preliminary data for fiscal year ended March 31 of year following that stated.
[8] Fiscal year ended June 30 of year stated.

Minor Metals

By Jack W. Clark [1]

BERYLLIUM

THE commercial raw material of beryllium is the mineral beryl, generally found in granite pegmatite dikes associated with lithium, columbium, and tantalum minerals. Other possible future sources of beryllium are idocrase (vesuvianite), helvite, garnet, and associated minerals which occur in certain deposits formed where igneous rocks have intruded limestone. The rare-earth mineral, allanite, which is available in commercial quantities, is a possible source, sometimes containing up to a few percent BeO. Bauxite and kaolinite contain 0.005–0.01 percent BeO.

Mine Production.—Output of beryl in the United States in 1949 is believed to have reached a record high, a figure of 475 tons being reported by operators. The large production was not related to feldspar or lithium-mineral recovery, for in each case production of these commodities in the beryl-pegmatite areas either declined or remained essentially unchanged from 1948. Instead, the spectacular rise was accounted for by the fortuitous opening up of clusters of very large beryl crystals in New Hampshire, by growing awareness on the part of mining interests of the profit possibilities of beryl, and by record prices for beryl, spurred upward through a combination of National Stockpile purchases and Atomic Energy Commission interest superimposed upon normal commercial demands.

Arizona produced beryl in 1949, for the first time in Bureau of Mines records, from a locality 12 miles northeast of Morristown, Maricopa County; from a deposit near Crown King, Yavapai County; and from the Rare Metals mine, about 60 miles southeast of Kingman in the Aquarius Mountains. Reserves of beryl at the latter property were estimated at 150 tons. One buyer reported small purchases of beryl from California and Nevada. Colorado producers of importance in 1949 were the Devil's Hole pegmatite property, Fremont County, and the Willow Creek property operated by Beryllium Mining Co. northwest of Ohio City. A small production was reported from a locality 30 miles from Whitewater, Mesa County, presumably in the Uncompahgre Plateau granite. Beryl Ores Co., Arvada, Colo., purchases and beneficiates low-grade beryl ore to standard commercial specifications. Northern Mining Corp. produced beryl in 1949 from the Bumpus quarry, Albany, and the Black Mountain deposit in Maine. A spectacular beryl crystal was uncovered in the Bumpus quarry measuring 27 feet 7 inches long, with

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

end diameters of 39 inches and 11 inches. Ashley Mining Co., producing from the Palermo mine, Grafton County, and the Beryl Mountain mine, South Acworth, Sullivan County, N. H., was the largest individual producer of beryl in 1949. Whitehall Mining Co., at the Ruggles quarry, near Grafton, and the N–49 Chandler quarry, near Raymond, also reported production. Arthur Montgomery's Harding mine, near Dixon, N. Mex., contributed significant production in 1949; a report on the Harding mine was published by the Bureau of Mines.[2] Twenty-seven and one-half tons of beryl were produced from the Harding mine as of February 1946. A small 1949 production of beryl came from the McKinney mine and various unspecified feldspar-mica properties in the Spruce Pine district of North Carolina. In South Dakota production came from 15 to 20 properties in 1949; the Consolidated Feldspar Corp. and Black Hills Keystone Corp. were large producers. In addition to its output of commercial-grade beryl, the latter company reported production of 500 tons of 2-percent (BeO) ore requiring beneficiation. Two hundred pounds of chrysoberyl were produced and sold from the Scott Rose Quartz mine. Discovery of possible commercial quantities of beryl was reported in Washington at Earl Cannon's mine, 18 miles north of Chewelah.[3] A small load of beryl was reported shipped from the Shoshoni area in Wyoming.

Beryllium concentrates (beryl) shipped from mines in the United States, 1943–49, by States, in short tons

State	1943	1944	1945	1946	1947	1948	1949
Colorado	68	35			(1)	(1)	100
Connecticut		(1)			(1)		
Maine	2	2			(1)	(1)	(1)
Massachusetts	(1)	4					
New Hampshire	42	(1)	1	5	(1)	(1)	(1)
New Mexico	(1)	29			(1)		8
South Dakota	238	306	38	95	70	45	69
Other [2]	6	12			75	54	169
Total: Short tons	356	388	39	100	145	99	346
Value	$44,407	$56,135	$6,133	$17,787	$25,214	$26,600	$111,073
Average value per ton	$124.74	$144.68	$157.26	$177.87	$173.89	$268.69	$321.02

[1] Included with "Other." Bureau of Mines not at liberty to show separately.
[2] Includes States indicated by footnote 1; in addition, 1943–44, North Carolina and Virginia; 1949, Arizona and North Carolina.

The Bureau of Mines and Geological Survey were both active throughout 1949 in pegmatite investigations in various States, conducting mapping, drilling operations, and reserve and mining studies. Reports of investigations of beryl deposits in Connecticut, Maine, and South Dakota were published by the Bureau.[4] A significant contribution to the literature of pegmatite geology was published by

[2] Berliner, M. Howard, Investigation of the Harding Tantalum-Lithium Deposits, Taos County, N. Mex.: Bureau of Mines Rept. of Investigations 4607, 1949, 7 pp.
[3] Engineering and Mining Journal, vol. 150, No. 12, December 1949, p. 125.
[4] Boos, M. F., Maillot, E. E., and Mosier, McHenry, Investigation of Portland Beryl-Mica District, Middlesex County, Conn.: Bureau of Mines Rept. of Investigations 4425, 1949, 26 pp.
Maillot, E. E., Boos, Margaret F., and Mosier, McHenry, Investigation of Black Mountain Beryl Deposit, Oxford County, Maine: Bureau of Mines Rept. of Investigations 4412, 1949, 10 pp.
Gries, John Paul, Sampling of Helen Beryl Pegmatite, Custer County, S. Dak.: Bureau of Mines Rept. of Investigations 4396, 1949, 14 pp.

the Geological Survey in 1949. Structural principles outlined in the study should be of considerable value in making future evaluations and in planning the mining development of pegmatite deposits.[5] Berylliferous pegmatites in Maine were described in other publications.[6] Five hundred and twenty tons of beryl reserves were inferred to a depth of 50 feet in the Red Hill pegmatites west of Rumford. Beryllium Development, Inc. (subsidiary of Beryllium Corp., Reading, Pa.), was organized to buy, sell, and mine beryl ore, with activities to be centered upon development of domestic ore supplies.

Refinery Production.—Beryllium Corp., Reading, Pa., and Brush Beryllium Co., Cleveland, Ohio, consume beryl for the production of beryllium metal, alloys, and compounds. Beryl Ores Co., Arvada, Colo., produced a small quantity of oxide in 1949 and planned to continue output in 1950. Clifton Products Co., Painesville, Ohio, a former large producer of fluorescent-grade oxide, was no longer active in commercial production, confining its efforts in the beryllium field to research.

In April 1949 the Atomic Energy Commission completed arrangements with the Federal Works Agency for use of a surplus wartime $5,000,000 magnesium-reduction plant at Luckey, Ohio, 15 miles south of Toledo. Construction of a new plant for beryllium production was completed on the site during the year, and the Brush Beryllium Co. engaged to operate the plant under contract. Operations were begun in November 1949, about 250 people being employed, according to reports.

The Champion Spark Plug Co., Detroit, Mich., and A. O. Smith Co., Milwaukee, Wis., consume beryl for ceramic purposes. Beryl Ores Co., Arvada, Colo., and the Foote Mineral Co., Philadelphia, Pa., grind and blend beryl for ceramic uses.

Consumption and Uses.—Beryl consumption in 1949 was 48 percent below a year earlier, principally because of slackening demand for beryllium-copper products.

The most important use of beryl is as a source of beryllium oxide needed for the production of beryllium-copper alloys. Master alloy, containing about 4 percent Be, from which other alloys are prepared, is made by the arc furnace fusion of a mixture of beryllium oxide, carbon, and copper powder. The beryllium-copper alloys are of great commercial and strategic significance, having no peer when shaped into parts that must simultaneously perform a mechanical function and conduct electric current at moderately elevated temperatures. The ease with which beryllium-copper may be formed and subsequently age-hardened is a factor of immeasurable importance in its utility; the rapidly quenched alloys are ductile (Brinell 100) and readily machinable or castable into complex shapes which then may be very substantially hardened (Brinell 350–400) and otherwise strengthened by the fabricator with a simple heat treatment. Both ductile and mill-hardened stock is available commercially, with the mill-hardened forms becoming increasingly important. Beryllium-

[5] Cameron, E. N., Jahns, R. H., McNair, A. H., and Page, L. R., Internal Structure of Granitic Pegmatites (Monograph 2, Economic Geology): Economic Geology Publishing Co., Urbana, Ill., 1949, 115 pp.

[6] Shainin, V. E., Economic Geology of Some Pegmatites in Topsham, Maine: Maine Geological Survey Bull. 5, Dec. 1, 1948, 32 pp. (p. 24).

Shainin, V. E., Preliminary Report of the Pegmatites on Red Hill, Rumford, Maine: Report of the State Geologist 1947–48, Maine Development Commission, March 1949, pp. 90–102.

copper alloys used in commercial practice range in beryllium content from about 0.25 to 2.85 percent, according to properties desired. Cobalt or nickel are generally added to confer additional desirable properties, and their presence is essential in those alloys containing less than 1 percent beryllium if the same precipitation-hardening effect which is conferred by beryllium at higher percentages is to be realized. Uses of beryllium-copper and methods for its forming and fabrication have been comprehensively treated in recent publications.[7] Commonly used beryllium-copper alloy compositions and some of their fields of application are listed in the accompanying table.

Approximate compositions and uses of commercial beryllium-copper alloys

Fabricating method	Physical characteristics	Percentage composition: copper plus—	Use
Wrought	High strength	1.90–2.15 Be 0.25–0.35 Co or Ni	Springs, bellows, electrical contacts, aircraft engine parts, cams, bearings and resistance welding electrodes.
Do	do	1.60–1.80 Be 0.25–0.35 Co or Ni	
Do	High conductivity	0.45–0.60 Be 2.35–2.60 Co or Ni	Current-carrying springs, switch parts, and other components where good electrical and thermal conductivity are desired at moderately elevated temperatures.
Do	do	0.25–0.50 Be 1.40–1.70 Co or Ni 0.90–1.10 Ag	Spot, seam, flash and projection welding dies and electrodes.
Cast	High strength	2.00–2.25 Be 0.35–0.60 Co or Ni	Sand, investment and plaster mold casting. Bushings, cams, marine propellers, pump parts, bearings, gears, safety tools, valve parts.
Do	do	2.60–2.85 Be 0.35–0.65 Co or Ni	Special purpose alloy for plastics molds and other applications requiring maximum strength, hardness and wear resistance.
Do	High conductivity	0.55–0.70 Be 2.35–2.60 Co or Ni	High-conductivity casting alloy for switches, circuit breakers, switch gear, welding jaws, resistance welding dies, electrode holders and other current-carrying members where strength, conductivity, and resistance to wear at moderately elevated temperatures are important.

Beryllium oxide has an unusual combination of high refractoriness, high dielectric properties at both normal and elevated temperatures, and superior resistance to thermal shock; in thermal conductivity it lies midway between 18–8 stainless steel and zinc. In consequence, beryllia is of great importance in high-quality porcelain compositions used for aircraft spark plugs[8] and ultrahigh-frequency (radar) insulators.[9] Beryllium oxide is also employed for refractories and crucibles, and as a component in special glass,[10] dehydrogenation catalysts,[11] phosphors, and synthetic emeralds.

[7] Richards, John T., Beryllium-Copper as a Spring Material: Machinery, vol. 55, No. 8, April 1949, pp. 169–174. What Beryllium-Copper Offers the Designer: Machine Design, vol. 21, No. 8, August 1949, pp. 117–123. How to Machine Beryllium-Copper: Am. Machinist, vol. 93, No. 3, Feb. 10, 1949, pp. 101–116. How to Heat-Treat Beryllium-Copper: Iron Age, vol. 163, No. 8, Feb. 24, 1949, pp. 78–84. Designing with Beryllium-Copper Casting Alloys: Materials and Methods, vol. 29, No. 9, September 1949, pp. 70–73.
Beryllium Corp. (Reading, Pa.), Beryllium-Copper Investment Casting: Bull. 11, April 1949, 4 pp.
Williams, H. G., Production of Metal Diaphragms: Beryllium Corp., Reading, Pa., September 1947.

[8] Riddle, Frank H., Ceramic Spark-Plug Insulation: Jour. Am. Ceram. Soc., vol. 32, No. 11, Nov. 1, 1949, p. 345.
Bartlett, Helen B., and Schwartzwalder, Karl, Trends in the Chemical and Mineralogical Constitution of Spark Plug Insulators: Am. Ceram. Soc. Bull., vol. 28, No. 11, Nov. 15, 1949, p. 470.

[9] Ceramic Age, Beryllia-Type Porcelain: Vol. 54, No. 2, August 1949, p. 95.

[10] Sun, Kuan-Han (assigned to Eastman Kodak Co.), Beryllo-Aluminate Glass: U. S. Patent 2,466,508, Apr. 5, 1949.

[11] Thacker, Carlisle M. (assigned to the Pure Oil Co.), Activated Alumina-Beryllium Oxide Catalyst: U. S. Patent 2,480,520, Aug. 30, 1949.

Until June 30, 1949, the principal use of beryllium oxide (aside from being a beryllium-copper raw material) was in the composition of beryllium-zinc silicate phosphors for fluorescent lamps; thereafter, lamp manufacturers, by mutual agreement, ceased its use for this purpose, substituting instead nontoxic calcium halophosphate.[12] A similar change-over was reported taking place in England.[13]

The zinc-base alloy, Zncube, containing 0.1 percent beryllium as an essential constituent, and 2 to 2.5 percent copper, shows much commercial promise. Developed by the General Electric Research Laboratory, and now undergoing fabrication tests by the Illinois Zinc Co., Chicago, Ill., Zncube is reported to be almost identical with cold-rolled 70–30 brass in strength properties; a cost advantage is claimed over the latter from the dual standpoints of lower price per pound and a volume-weight relationship favoring Zncube by some 15 percent. Corrosion resistance is markedly superior to that of any other commercial zinc alloy. Zncube would find use in fabrication of lamp and fuse sockets and bases and hardware and would generally replace brass and some bronzes.

Beryllium (1 to 2 percent) added to stainless steel confers strength-retention at red heat. The important surgical and dental alloy, Ticonium (Ni-Co-Cr-Mo), contains 1 to 6 percent Be. Beryllium-nickel is employed as diamond-drill-bit matrix metal and in precision castings demanding high strength, hardness, and toughness. Use of beryllium in magnesium and aluminum foundries is commonplace, traces of the element (0.005 percent) reducing the flammability of magnesium and 0.05 to 0.5 percent, promoting melt fluidity, and refining the grain of aluminum.

Beryllium metal, as such, has had only limited commercial application to date, being used mostly for X-ray tube windows and, combined with radium or polonium, as a neutron source. Beryllium has major importance in certain nuclear reactor designs because of its moderating effect upon fast neutrons emitted by the fission of U–235 and plutonium. Great advances have been made very recently in producing high-purity beryllium metal and in fabricating items of previously unheard-of size and intricacy.

Stocks.—Industry inventories of beryl at the 1949 year end were a little more than double those of 1948, providing a brightened raw material outlook for 1950. All beryl stocks remaining in the World War II stockpile of the Office of Metals Reserve were transferred late in 1949 to the Bureau of Federal Supply for inclusion in the National Stockpile.

Prices.—Nominal quotations for beryl as published in the E&MJ Metal and Mineral Markets for 1949 were as follows for domestic ore, f. o. b. mine, per unit BeO, 10–12 percent BeO: January 13, \$26–\$28; January 27, \$26–\$30; April 7, \$25–\$30; June 4, \$25–\$35; August 4, \$30–\$35; October 27, \$35 (Colorado), \$25–\$30 (North Carolina). For imported ore, c. i. f. United States ports: January 27, \$26–\$28; August 4, \$25–\$30; October 27, \$26–\$30. Beryllium-copper, 4 percent Be, \$24.50 per pound of contained Be, plus the price of copper at

[12] Oil, Paint and Drug Reporter, Halogen Ingredients Replacing Beryllium: Vol. 155, No. 19, May 9, 1949, p. 4.
[13] Ceramic Age, Beryllium Poisoning Hazards: Vol. 54, No. 2, August 1949, p. 95.

market. This price was the same during 1948. Prices of all other beryllium products such as metal. alloys, oxide, and other compounds showed almost no change from 1948.

Foreign Trade.—United States imports of beryl increased abruptly for the second successive year, reaching the highest level on record since 1943, when 4,840 tons were received. In 1949 domestic receipts from Brazil, the world's largest producer of beryl, reached an all-time high. The 107 tons received from Japan represented reshipment of old stocks originally purchased by the Japanese from Argentina or Brazil. Receipts from French Morocco were the first on record.

Exports of beryllium metal, alloys, and scrap from the United States in 1949 totaled 187,927 pounds, valued at $481,767. Principal recipient countries were the United Kingdom 128,386 pounds, Sweden 24,457, Canada 14,627, and Australia 7,129, the balance going to 8 other countries. Exports of ore and concentrates were 691 pounds, valued at $2,087, to Canada and Switzerland.

Nine metric tons of beryl were purchased by the Economic Cooperation Administration, using local currency counterpart funds, at a cost equivalent to $3,300.[14] $5,000 was authorized by ECA to Bizone Germany for procurement of beryllium alloys from the United States.[15]

Beryllium ore (beryl concentrates) imported for consumption in the United States, by countries, 1945–49, in short tons

[U. S. Department of Commerce]

Country	1945	1946	1947	1948	1949
Argentina		53		55	
Australia	105	20	45		
Brazil	572	[1] 996	722	[1] 1,545	3,264
British East Africa	7				11
Chile				(2)	
French Morocco					22
Hong Kong				18	
India	484	119			
Japan					107
Madagascar	11				
Mozambique				55	107
Nigeria	22				
Norway					10
Union of South Africa				47	290
Total: Short tons	1,201	[1] 1,188	767	[1] 1,720	3,811
Value	$131,841	$105,708	$114,667	[1] $299,375	$858,308

[1] Revised figure.
[2] Less than 1 ton.

Technology.—Methods for metallographic examination of beryllium and its alloys were developed [16] and a technique described for the production of large beryllium metal castings.[17] Patents were issued in 1949 covering methods for producing beryllium metal, alloys,[18] and fluoride,[19] and for the purification of ammonium beryllium fluoride.[20]

[14] Economic Cooperation Administration, Sixth Report to Congress, for the quarter ended Sept. 30, 1949, p. 60.
[15] Oil, Paint and Drug Reporter, vol. 156, No. 14, Oct. 3, 1949, p. 4.
[16] Udy, M. C., Manning, G. K., and Eastwood, L. W., Metallographic Examination of Beryllium Alloys: Jour. Metals, vol. 1, No. 10, October 1949, pp. 779–784.
[17] Kura, J. G., Jackson, H. H., Udy, M. C., and Eastwood, L. W., Preparation and Casting of Beryllium Melts: Jour. Metals, vol. 1, No. 10, October 1949, pp. 769–778.
[18] Kawecki, Henry C. (assigned to the Beryllium Corp.), Method of Producing Metallic Beryllium and Alloys of Beryllium: U. S. Patent 2,486,475, Nov. 1, 1949.
[19] Peterson, Warren S., and Willmore, Charles B. (assigned to Aluminum Co. of America), Producing Beryllium Fluoride: U. S. Patent 2,487,270, Nov. 8, 1949.
[20] Kawecki, Henry C. (assigned to The Beryllium Corp.), Purification of Ammonium Beryllium Fluoride: U. S. Patent 2,490,633, Dec. 6, 1949.

A novel device was under development for concentration of beryl involving the use of an induced nuclear reaction.[21] The sorting process is based upon the emission of neutrons from beryllium minerals which have been exposed to gamma radiation from a van de Graaff generator. The reaction is specific for beryllium at certain gamma radiation energy levels; the signals given by neutrons when ore passes on a belt are changed to mechanical commands through amplifiers and other electrical equipment. Pieces of beryl weighing as little as 1 gram each were picked at the rate of 5 per second.

WORLD REVIEW

North America.—According to advice received by the Bureau of Mines from Government agencies concerned with mineral resources in the various Provinces of Canada, beryl deposits of potential commercial importance are at present known to exist only in Manitoba, Ontario, and the Northwest Territories. Beryl occurrences have been found also in British Columbia, Nova Scotia, and in numerous localities in Quebec. The Department of Natural Resources, St. Johns, reports that no beryl deposits having commercial possibilities have yet been discovered in Newfoundland or Labrador. No beryl has been reported from New Brunswick. Extensive areas favorable for the occurrence of pegmatite dikes and, hence, of beryl exist in the northern half of Saskatchewan and the northeastern corner of Alberta. The fact that, in general, appreciably greater rewards may be realized by a prospector from the discovery or development of precious metal, uranium, and base-metal deposits has been responsible in large part for the relatively little attention paid to Canadian pegmatite deposits, except in the more populous and accessible southern areas.

World production of beryllium concentrates (beryl), by countries,[1] 1940–49, in metric tons

[Compiled by Berenice B. Mitchell]

Country	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
Argentina	520	2,186	925	881	342	190	130	10	[2] 50	(3)
Australia	2	3	------	534	417	47	19	54	56	21
Brazil (exports)	1,472	1,703	1,634	2,027	1,185	510	1,294	1,027	1,783	3,078
French Morocco	------	------	------	------	------	------	------	------	51	211
India	53	(4)	121	1,486	508	108	112	(3)	(3)	(3)
Korea, South	(3)	(3)	(3)	(3)	17	9	(3)	(3)	------	------
Madagascar	(3)	(3)	(3)	[2] 67	50	[5] 10	(3)	(4)	(3)	(3)
Mozambique	(3)	(3)	8	6	3	2	22	61	81	(3)
Portugal	(3)	35	(3)	14	[5] 60	9	(3)	------	[5] 10	[5] 20
South-West Africa	(2)	20	39	36	1	5	------	52	90	239
Spain	4	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Uganda	(3)	(3)	(3)	------	18	4	------	18	44	34
Union of South Africa	------	------	------	------	------	------	------	------	------	223
United States (mine shipments)	110	142	244	323	352	35	91	132	90	314
World total (estimate) [6]	2,161	4,090	2,971	5,374	2,958	929	1,700	1,360	2,470	4,450

[1] In addition to countries listed, beryllium concentrates may also be produced in Finland, France, Kenya, Norway, Rumania, Southern Rhodesia, Tanganyika, and U. S. S. R. Canada has produced beryl but reported no sales.

[2] Estimate based on United States imports.

[3] Data not available; estimates by author of chapter included in total after 1945.

[4] Less than 1 ton.

[5] Estimate.

[6] Exclusive of U. S. S. R. Production in other countries for which data are not available is believed to be negligible.

[21] Pannell, James H., and Freyberger, Wilfred L., The Beryl Picker: Massachusetts Inst. Technol. Mineral Eng. Lab. Topical Rept. MITG-224, Sept. 20, 1949, 18 pp.

Beryl occurs in many pegmatites in the Cat Lake-Winnipeg River area about 90 miles northeast of Winnipeg, Manitoba, near the Ontario boundary. Occurrences of possible commercial importance have been noted west and north of Rush Lake, west of Cat Lake, north and east of Bernic Lake, south of Shatford Lake, and west and southeast of Greer Lake which lies south of the Winnipeg River. White, green, and golden varieties are found.[22] Crystals of beryl up to 1 foot in diameter have been observed. Vigorous development in 1949 by Northern Chemicals Ltd., Winnipeg, of nearby dikes rich in lithium minerals indicates a favorable trend toward possible ultimate exploitation of the beryl-rich dikes. Northern Chemicals, Ltd., reported that the company was giving attention to the recovery of beryl. Late in 1949 a new 45-mile truck haulage road was nearly completed, linking the region in which the spodumene and beryl dikes occur with the railhead at Lac du Bonnet.[23] Winnipeg River Tin Mines, Ltd., with 25 claims north of Pointe du Bois on the Winnipeg River, reported that a large tonnage of beryl was available from its holdings provided suitable beneficiation methods could be developed, the beryl crystals being too small for hand cobbing.

In Ontario, beryl is found in Lyndoch township, Renfrew County. Work was begun on this property in 1926 when a few tons of beryl crystals were recovered. Subsequent work has been done by the present owners, Canadian Beryllium Mines & Alloys, Ltd., Toronto.[24] Crystals of beryl up to 6 to 8 inches in diameter and 3 feet or more in length have been found.

Pegmatites containing beryl, and believed to have commercial possibilities, occur over an extensive area north and east of Yellowknife on the northern shore of Great Slave Lake, Northwest Territory. Associated are columbite-tantalite, tin and lithium minerals, and mica. Beryl crystals about 1 foot in diameter are reported. Companies with holdings in the area are De Steffany Tantalum Beryllium Mines, Ltd., Edmonton, Alberta, and Tantalum Refining & Mining Corp. of America, Ltd., Toronto, Ontario.

Beryl of possible commercial importance is found in pegmatite in the Godthaab and Julianehaab districts in western Greenland and also along the eastern coast.

South America.—The States of Paraiba, Rio Grande do Norte, and Ceara in northeastern Brazil have been the source of the major portion of world beryl production. High-grade tantalite is recovered as an important coproduct, its salability having an important bearing upon beryl productivity at price levels that have prevailed to date. Commercial beryl deposits are also reported in Pernambuco, southern Bahia, and in the Doce River Basin of Minas Gerais.

Europe.—Beryllium metal was reported produced in 1947 in the laboratory of the Praz factory in Maurienne, *France*. Production was immediately expanded to the pilot-plant stage, the output late in 1949 amounting to several kilograms of 99.9 percent purity per day. The Calypso factory, destroyed during the war, is being rebuilt, and

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[22] Springer, G. D., Geology of the Cat Lake-Winnipeg River Area, Lac du Bonnet Division, Manitoba (Preliminary report and map): Mines Branch, Department of Mines and Natural Resources, Province of Manitoba, 1949, 15 pp. (pp. 14-15).

[23] Northern Miner, vol. 35, No. 25, Sept. 15, 1949, p. 7

[24] Dominion Bureau of Statistics Department of Trade and Commerce, Miscellaneous Metals Industry 1948, p. 5.

beryllium will be produced there on an industrial scale. A factory at St. Jean de Maurienne makes beryllium copper.[25] Production of beryllium is prohibited in *Western Germany* by agreement among France, the United States, and the United Kingdom.[26] Production of beryl as a byproduct of feldspar and quartz mining in *Portugal* was unofficially reported at 15 to 20 metric tons in 1949. Exports were destined for France. The geological survey departments of the colonies were officially informed in 1949 that the *United Kingdom* wished to purchase all available supplies of beryl, principally for atomic energy use. Production was reported underway in several colonies, including Nigeria.[27]

Africa.—Beryl is known to occur in deposits of possible commercial importance in pegmatite in eastern *Belgian Congo* and in *Ruanda-Urundi.*[28] A beryl deposit of commercial note is reported in the Gedewa Mountains, southeast of Massawa, *Eritrea,* northeast of Ethiopia.

Mines des Zenaga in the Anti-Atlas Mountains of *French Morocco* began production of beryl in October 1948. In 1949, output was about 200 metric tons, averaging 12 percent BeO. Twenty tons were exported to the United States in 1949. Mining concessions of the company cover about 150 square kilometers. Production to date has come from a single dike, but some 15 dikes show beryl crystals on the surface. The company reported that production could probably be increased severalfold. Some of the beryl crystals are large, measuring 70 centimeters in diameter by 90 in length. Pegmatites containing beryl in commercial quantity are numerous in the central and southeasterly parts of the island of *Madagascar* especially in the province of Fianarantsoa. Crystals up to 3 meters long have been found at Manakana, northwest of Antalaha in the region of Tsaratanana. The approximate prices of Madagascan beryl concentrates, 12 percent BeO, were reported in August 1949 to be about 25,000 francs CFA (1 CFA franc equals 1 metropolitan French franc) per metric ton, f. o. b. mine, up to 35,000 francs, f. o. b. port.[29] All exports of beryl are reserved for France. Sale and transport of beryl are under authority of the Chef du Service des Mines, acting under authority conferred by the Comite de l'Energie Atomique. The Commissariat a l'Energie Atomique (France) has the prior right of purchase but may, and has, authorized purchase by private firms, such as Alais, Froges et Camargue. Exploration for and exploitation of beryl deposits in Madagascar is conducted by private companies and individuals. By a decree of April 5, 1946, the sale price of beryl must be determined anew each year in each territory of Madagascar by decision of the Chef du Territoire, under advice of the Chef du Service des Mines.[30]

Output of 25 tons of beryl came from the Fort Victoria district, *Southern Rhodesia*, in 1949.

[25] Chemistry and Industry, No. 38, Sept. 17, 1949, p. 654.
[26] Mining World, vol. 11, No. 9, August 1949, p. 47.
[27] Records and Statistics, Colonial Minerals: Vol. 6, No. 137, Aug. 27, 1949, p. 189.
[28] Buttgenbach, H., Les Mineraux de Belgique et du Congo Belge: H. Vaillant-Carmanne, S. A., Liége, Belgium, 1947, pp. 279–280.
[29] Echo des mines et de la métallurgie, No. 3415, August 1949, p. 200.
[30] Lescop, René, Le Béryl à Madagascar: Echo des mines et de la métallurgie, No 3415, December 1949 p. 327.

Beryl pegmatites are numerous in an area exceeding 1,000 square miles in the northwest part of Cape Province *Union of South Africa* and southern part of *South-West Africa*, including portions of Namaqualand and Bushman Land, the Gordonia district of the Cape Province, and the Warmbad district of South-West Africa.[31] Under the stimulus of high prices beryl mining was resumed in 1948–49; total production for the region (exclusive of beryl produced as a by-product of lithium ores in the vicinity of Karabib, northeast of Walvis Bay, South-West Africa) to September 1949 was about 250 short tons, most of which was produced in 1949. The area in which the beryl occurs is a desert and is virtually uninhabited. A large percentage of current production comes from alluvial deposits near the dikes. Very large crystals have been found, measuring several feet in length and diameter. Beryl occurs in *Tanganyika* at Ufipa, in the Uluguru Mountains, in the Central Province northeast of Dodoma, and at Namaputa in the Lindi district.[32] Production of beryl in *Uganda* in 1948 reached 43.54 metric tons, all from Ankole. In addition, several tons of beryl were on hand at the Mbale Estate, Singo County, Mengo.[33]

Asia.—Rich deposits of beryl are reported to have been discovered in the Hsingan Mountains of *Manchuria* by the Manchurian Mining Co. during the Japanese occupation and plans made for their exploitation. The export embargo on beryl established by *India* in mid-1946 continued unrelaxed in 1949. The Government sought assistance in establishing a beryl-processing plant. Beryl productivity in India is potentially very large. Output has come principally from the United State of Rajasthan (formerly Rajputana) and also from Nellore, Madras State; Hazaribagh, Bihar State; and Kashmir. Beryl has been found in Rajasthan in crystals up to 20 feet long by 2 feet in diameter.[34] Santoku Ind. Co., Ltd., *Japan*, has a small beryllium oxide plant in Tokyo said to be capable of producing several hundred pounds of oxide per month. Beryl occurs at the Naegi mine (Gifu Province) and the Ishikawa mine (Fukushima Province). Santoku Kogyo Kaisha built a plant in Tokyo in 1939 to produce about 2,200 pounds of beryllium a year for alloying with copper. Small quantities of beryl are found in Ibaraki and Kyoto prefectures. Beryl occurs as a minor mineral in a tungsten-quartz vein at the Chongyang mine in Chungchong-Namdo, *South Korea*; a small amount was produced by the Japanese during World War II.

Russian publications (pre-World War II) referring to beryllium technology and ore deposits in the *U. S. S. R.* are numerous.[35] Work on beryllium technology in the Soviet Union was begun in 1922 by the Bureau of Rare Elements, being transferred to the Institute of Rare Elements in 1931. At the beginning of 1932, the first semi-industrial equipment was placed in operation for producing beryllium metal. Finally, in 1933 the New Metals Works began the electrolytic produc-

[31] Vanderburg, William O., Report on Beryl Ore Sampling (with Notes on the Beryl Occurrences in Namaqualand, Cape Province and Warmbad District, South-West Africa): American Embassy, Pretoria, South Africa, Consular Rept. 212, Oct. 5, 1949, 8 pp.
[32] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 4, October 1949, p. 4.
[33] Mining Journal (London), Mining in Uganda in 1948: Vol. 234, No. 5979, Mar. 24, 1950, p. 290.
[34] Fox, Sir Cyril, Internal Structure of Granitic Pegmatites (Review): Mining Jour. (London), vol. 233, No. 5966, Dec. 24, 1949, p. 1237.
[35] Sinegub, E. S., Berill: Nemetallicheskiye iskopayemye S. S. S. R., Moscow-Leningrad, vol. 2, 1943, pp. 129–157. Pub. by Akademiya Nauk, Moscow-Leningrad.

tion of beryllium. Beryl occurrences are numerous and widespread in the Soviet Union, localities ranging from the Chukotsk Peninsula facing Alaska in the east to the Armenian S. S. R. in the southwestern extremity adjoining Turkey and Iran. Known deposits of commercial importance, or potentially commercial, are few; however, of these, the famous Uralian emerald mines in the vicinity of Sverdlovsk on the east flank of the central Ural Mountains are the most important. The emerald pegmatite zone, in which commercial beryl also is found, varies from 100 to 600 meters in width and extends about 20 kilometers in length roughly paralleling the trend of the Urals. Exploration was conducted in 1933 at the important Malyshevski mine, results of which indicated the existence of large reserves of beryl; the investigation covered only a small part of the mineralized area. Probably second in commercial importance to the Ural area is the ancient Sherlova Gora mine east of Lake Baikal and about 250 kilometers east-southeast of Chita at a point near the common boundary point of eastern Siberia with Manchuria and Mongolia. Beryl is found in this locality in tungsten (ferberite)-quartz veins. Between Lake Baikal and the Yenisei River, north-northeast of Krasnoyarsk about 300 kilometers, lies the important Taseyevski mica mine in the Yuzhno-Uderei region; beryl crystals one-half meter long by 30 centimeters in diameter have been found here in pegmatite. In western Siberia large beryl crystals 1.5 meters long by over 25 centimeters in diameter occur in pegmatite at the Tigiretz deposit about 200 kilometers northeast of Semipalatinsk (Kazakh S. S. R.). Important occurrences of beryl exist in the Lake Balkhash region of eastern Kazakhstan, notably east of the railroad running north to Karaganda (tungsten veins), southeast of Ust Kamenogorsk (pegmatite), and about 300 kilometers northeast of Alma-Ata near the Sinkiang frontier. Other deposits of beryl pegmatites having commercial possibilities are known near Stalinabad, southeast of the city of Isfara, in the Tadzhik S. S. R.; associated economic minerals are tin and columbite. In addition to the localities listed, and regions adjacent to them, beryl deposits have been discovered in Pamir on the Afghanistan border, in the Caucasus Mountains of south Russia, in the Kzyl Kum region in the northwest of the Uzbek S. S. R., and in the Yakutsk S. S. R. in the region of the Lena and Andych Rivers, northeastern Siberia.

Australia.—Commercially noteworthy occurrences of beryl are found in every State in Australia, except Victoria, and production has been reported from all but the Northern Territory and Tasmania. Output for 1939–47, inclusive, has been reported as follows:[36] Queensland (Mount Isa), 12.85 long tons; New South Wales (Broken Hill district), 35.65 tons; South Australia (Olary district), 13.85; and Western Australia, 1,010.24. Of the Western Australian production, 710 long tons came from Wodgina, 70 miles south of Port Hedland, as a byproduct of tantalite mining. Wodgina beryl is rich in cesium, containing 0.72–0.92 percent Cs_2O. Beryl from Melville, near Geraldine, showed cesium and rubidium contents of 1.72 and 1.42 percent Cs_2O and Rb_2O, respectively. Productive deposits of beryl in Western Australia are scattered over an extensive area between

[36] Sullivan, C. J., and Ludbrook, N. H., Beryllium: Commonwealth of Australia, Dept. of Supply and Development, Bureau of Mineral Resources, Geology and Geophysics, Mineral Resources of Australia, Summary Rept. 18, 1948, 17 pp.

Port Hedland in the north to Balingup, south of Perth. Exportation of Australian beryl is prohibited, except for United Kingdom requirements. The United Kingdom Ministry of Supply purchases Australian beryl through its agent O. T. Lempriere & Co. Pty., Ltd. The price per long-ton unit, minimum BeO content 9.5 percent, bagged, f. o. b. main ports, was £A 5 until March 25, 1949, when the figure £A8, 2s. 6d. was posted.[37]

CALCIUM

Production.—Calcium metal is produced in the United States by the Electro Metallurgical Division, Union Carbide & Carbon Corp., Sault Ste. Marie, Mich., and the New England Lime Co., Canaan, Conn. Production of calcium metal in 1949 was about 20 percent below that in 1948; producers' shipments declined 34 percent. The Ethyl Corp. was reported to be considering production of calcium metal on a comparatively large scale as a byproduct of its sodium-metal operations at Baton Rouge, La.

Uses.—The metal is used principally in ferrous and nonferrous alloy production and as a basic raw material in the process for making calcium hydride.

Prices.—Calcium metal, in the form of slabs and small pieces was quoted in E & M J Metal and Mineral Markets in 1949 at $1.95 per pound, ton lots, until January 27, when an increase to $2.05 was noted, remaining unchanged thereafter.

Foreign Trade.—All domestic receipts of calcium metal originated in Canada and France, respectively.

Calcium metal and calcium-silicon imported for consumption in the United States, 1946–49

[U. S. Department of Commerce]

Commodity	1946		1947		1948		1949	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Calcium metal			354	$675	796	$2,483	3,510	$4,736
Calcium-silicon	661,200	$87,647			429,488	52,378	112,000	14,977

Canada.—Annual output of calcium metal by Dominion Magnesium Ltd., Haley's Station, near Ottawa, Ontario, Canada, has been as follows: 1949, 556,521 pounds; 1948, 1,104,562; 1947, 723,461; 1946, 53,548; and 1945, 29,543.

CERIUM AND OTHER RARE-EARTH METALS

The mineral monazite has been by far the most important raw-material source of the rare earths to date. During 1949 lode deposits of rare-earth minerals of probable commercial importance, other than monazite, were made in the United States by prospectors engaged in searching for radioactive minerals. The rare-earth fluocarbonate, bastnaesite, was found widely distributed over an area of several square miles at a locality in southeastern California near Mountain

[37] Metal Bulletin (London), No. 3394, May 24, 1949, p. 15.

Pass Service Station, 53 miles southwest of Las Vegas, Nev., and 33 miles northeast of Baker, Calif. In the fall of 1949 rare-earth minerals of unknown mineralogic identity were found in large quantities about 9 miles north of Sundance, in the vicinity of Warren Peak in the Bear Lodge Mountains, northeastern Wyoming.

Production.—Lowered demand for ferrocerium alloy in 1949 caused a concomitant decline in output of both ferrocerium and the parent master alloy, misch metal. Producers of misch metal are Cerium Metals Corp., Niagara Falls, N. Y.; General Cerium Co., Edgewater, N. J.; and New Process Metals Co., Newark, N. J. Companies producing rare-earth magnesium alloys in 1949 were Dow Chemical Co., Bay City, Mich.; Howard Foundry Co., Chicago, Ill.; and American Light Alloys, Little Falls, N. J.

Consumption and Uses.—Misch metal is consumed principally in the production of the pyrophoric alloy, ferrocerium, which in turn is cast into thin rods and cut into short lengths for use as lighter flints. About 3,000 standard-size flints are obtainable per pound of ferrocerium. The use of misch metal is of strategic importance in the case of magnesium alloys required for high-temperature service, particularly in jet engines. About 3 percent misch metal is incorporated in such alloys,[38] along with 0.1–0.8 percent zirconium and, in some cases, 2–4 percent zinc. As a metallurgical additive in cast iron[39] and aluminum and copper alloys, misch metal is of growing significance.

Prices.—In 1949 misch metal averaged $4 per pound, unchanged from 1948; ferrocerium averaged $5.50 per pound, as compared to the 1948 figure of $8.

Foreign Trade.—220 pounds of misch metal and 4,436 pounds of cerium compounds, valued at $880 and $1,861, respectively, were imported in 1949. All receipts were from France.

Exports of ferrocerium and misch metal in 1949 totaled 70,009 pounds valued at $260,922 as compared to 55,133 pounds, valued at $323,582 in 1948. Recipient countries were Germany, 31,742 pounds; Portugal, 13,658; United Kingdom, 9,512; Canada, 5,205; Austria, 5,000; Belgium, 1,981; Sweden, 1,727; France, 964; Greece and Brazil, 220.

COLUMBIUM (NIOBIUM) AND TANTALUM

Mine Production.—Beryllium Mining Co., Inc., produced 1,020 pounds of columbium-tantalum minerals in 1949 at its Willow Creek property northwest of Ohio City, Colo. This material was not shipped.

Domestic Refineries.—Ferrocolumbium and ferrocolumbium-tantalum alloys are produced by the Electro Metallurgical Division, Union Carbide & Carbon Co., Niagara Falls, N. Y. Tantalum and columbium metal and compounds are made by Fansteel Metallurgical Corp., North Chicago, Ill. Tantalum and columbium metal in powder form and as the hydride compound are produced by Metal Hydrides, Inc., Beverly, Mass.

[38] Leontis, Thomas E., The Properties of Sand-Cast Magnesium-Rare-Earth Alloys: Jour. Metals, vol. 1, No. 12, December 1949, pp. 968–983.

[39] Murrough, H., Nodular Graphite Structures Produced in Gray Cast Irons: Am. Foundryman, vol. 13, April 1948, pp. 91–106.

Columbium and tantalum concentrates shipped from mines in the United States, 1940–44 (average) and 1945–49

Year	Columbium concentrates		Tantalum concentrates	
	Pounds	Value	Pounds	Value
1940–44 (average)	1,796	$476	3,413	$10,266
1945	1,149	287	5,500	13,366
1946			3,475	8,793
1947			3,259	8,677
1948	100	(1)	500	(1)
1949				

1 Bureau of Mines not at liberty to publish figure.

Uses.—Columbium finds its principal use as a carbide stabilizer in stainless steels and for imparting superior creep resistance and fatigue strength to alloys employed in jet-engine and gas-turbine construction. Columbium metal, as such, has found little application to date. Inadequacy of columbium ore supplies in the face of mounting demand for alloys containing columbium has provided the impetus for a vigorous program of research devoted to development of substitutes for columbium. Vanadium, titanium, and tantalum have shown promise. Low-carbon stainless steels have been recently developed which are reported to be suitable for many uses where the columbium-stabilized alloy had been formerly specified; in December 1949 Carnegie-Illinois Steel Corp. announced itself ready to begin commercial production of such steels.

Tantalum is most widely used in metal form, its properties of corrosion resistance (almost the same as glass), ease of fabrication, and high melting point making it especially useful in the chemical and electronics industries. Tantalum metal is extensively employed in surgical repairs; tantalum surgical products, such as sheet, foil, wire, gauze, ribbon, plates, and screws are distributed by Ethicon Suture Laboratories, Division of Johnson & Johnson, New Brunswick, N. J. Tantalum-tungsten alloy (92.5 percent Ta) is important in electronic tubes for spring components and is also suitable for springs and clips in plating and electropolishing baths. Tantalum carbide is used in Tantung, a cutting-tool alloy (cobalt-chromium-tungsten), and in cemented-carbide tools, wire-drawing dies, and special shapes. Cemented carbides containing tantalum (and columbium) are made by the Vascoloy-Ramet Division of Fansteel Metallurgical Corp. Cast alloys sold under the trade names of Tantaloy and Fanweld also contain tantalum carbide. Tantalum-metal electrodes are said to be superior for the electrochemical production of nitrogen oxide.[40]

Tantalum compounds are used as catalysts and optical glass components. Tantalum oxide, free of silica, fluorides, and all saline impurities and containing a small amount of iron oxide, is said to be an excellent wound dressing.[41] The tantalum electrolytic condenser was an important development in 1949 and is now available commercially. The Balkite rectifier and current-surge arrester each contain tantalum as an essential component in their construction.

40 Cotton, W. J. (assigned to Koppers Co., Inc.), Method of Electrochemically Producing Nitrogen Oxide in the Presence of Tantalum Electrodes: U. S. Patent 2,485,478, Oct. 18, 1949.
41 Olsen, Carl T. and Hoffman, Roger W. (assigned to Fansteel Metallurgical Corp.), Tantalum Oxide Composition: U. S. Patent 2,491,416, Dec. 13, 1949

Prices.—Metal Bulletin (London) quotations on columbite, 50–55 percent combined oxides (Cb_2O_5 plus Ta_2O_5), per unit c. i. f., opened the year at 70s.–75s.; successive increases were recorded as follows: February 18, 1949, 72s.6d.–77s.6d.; July 26, 77s.6d.–82s.6d.; November 4, 100s.–105s.; and November 25, 110s.–115s.; no further change was recorded thereafter to the end of 1949. E&MJ Metal and Mineral Markets quoted tantalum ore, 60 percent minimum Ta_2O_5, at $2–$2.75 per pound Ta_2O_5 until May 26, 1949, when a small decline was registered at $2–$2.50, from which level there was no change thereafter. Prices of columbium and tantalum metal in rod, sheet, and powder form were unchanged from 1948. Ferrocolumbium was quoted throughout 1949 at $2.90 per pound of Cb contained; this price was established on December 23, 1948.

Stocks.—No data are available on stocks of columbium or tantalum in any form. Columbite and tantalite are among the commodities acquired for the National Stockpile.

Foreign Trade.—Receipts of columbite from Nigeria, the most important producing country, declined sharply in 1949 for the second successive year and sank to the lowest level since 1940. As Nigerian columbite accounts for the major share of United States imports of this commodity, the total receipts from all countries showed a closely concomitant decline, falling to the lowest point since 1941. Columbium alloys were imported from Norway in 1949; a total of 103,638 pounds was received, valued at $102,215. Total tantalite imports in 1949 exceeded the abnormally low year 1948 by only a scant 7 percent and, with the exception of 1948, were the lowest since 1939.

Exports of columbium ore and concentrates in 1949 were 11,200 pounds, valued at $8,400, to Sweden, and 6,834 pounds, valued at $3,596, to Germany. Tantalum ore and concentrates, totaling 3,222 pounds, valued at $3,450, went to Sweden. Exports of columbium and tantalum metal and alloys were 90 and 3,483 pounds, valued at $460 and $92,082, respectively. Most of the tantalum metal and alloys went to the Union of South Africa, Australia, Germany, and France.

Columbium and tantalum ores (columbite and tantalite concentrates) imported for consumption in the United States, 1947–49, by countries, in pounds

[U. S. Department of Commerce]

Country	Columbium ore			Tantalum ore		
	1947	1948	1949	1947	1948	1949
Argentina					1,074	
Australia				9,468		
Belgian Congo	2,734	113,813	198,585	311,526	[1] 93,939	38,086
Belgium-Luxembourg		27,125		3,199		
Brazil		[1] 6,926	8,568	71,634	9,202	63,478
Mozambique			1,200			
Netherlands						29,500
Nigeria	2,818,900	1,822,843	1,349,126	7,998	14,559	4,480
Southern Rhodesia				24,928	8,914	
Union of South Africa		1,821				1,120
United Kingdom		1,200				
Total: Pounds	2,821,634	[1] 1,973,728	1,557,479	418,753	[1] 127,688	136,664
Value	$857,550	[1] $658,950	$561,945	$386,934	[1] $82,799	$237,292

[1] Revised figure.

WORLD REVIEW

Belgian Congo.—Production comes from Kivu Province and the adjoining Trusteeship area of Ruanda-Urundi, the columbite and tantalite being a coproduct of tin mining. Substantial reserves of columbite-tantalite are indicated.

Brazil.—The pegmatite deposits of the northeastern States of Paraiba and Rio Grande do Norte have furnished most of the world supply of high-grade tantalite, where the mineral is produced as a coproduct in the mining of beryl. Near-record demand for beryl, in contrast to consumer disinterest in tantalite, continued to cause the accumulation of large unsold stocks of the latter mineral.

Canada.—Peg Tantalum Mines, Ltd., was absorbed into Tantalum Refining & Mining Corp. of America, Ltd., in 1948. The latter organization carried out further development work on its tantalite holdings at Ross Lake northeast of Yellowknife, Northwest Territory, during 1949.

Nigeria.—Almost all of the world production of high-grade columbite has come from the tin placers of northern Nigeria. Exhaustion of the richer tin gravels has brought about a significant decline in output of columbite, which is recovered as a byproduct. Producers indicated that appreciably higher prices for columbite and/or tin concentrates might have to be realized to permit profitable working of lower-grade gravels.

Norway.—Columbite and koppite (calcium columbate) are found disseminated in limestone about 65 miles southwest of Oslo, on the southwest shore of Lake Nordsjø, near Ulefoss, Telemark County. The phosphate mineral, apatite, makes up about 6–10 percent of the limestone. Average columbium content of the ore is 0.2–0.3 percent. During the German occupation of Norway in World War II, I. G. Farbenindustrie conducted a program of diamond drilling and beneficiation research with the object of ultimately producing agricultural limestone, phosphate minerals, and columbium concentrates. A large reserve of columbium minerals was indicated. Similar deposits occur near Freiberg, Germany, and in the Sukula limestone of Uganda. There seems a strong likelihood that such deposits may have been overlooked elsewhere.

Southern Rhodesia.—Tantalite and the aluminum tantalate mineral, simpsonite, occur with tin minerals in the Bikita district east of Salisbury. In the fall of 1949, production of simpsonite was reported proceeding at the rate of 0.5–0.75 ton per month.

U. S. S. R.—Although columbium and tantalum minerals undoubtedly occur in many widely scattered pegmatite deposits, the apatite mines of the Kola Peninsula north of the White Sea probably are the greatest potential source. In this region, large quantities of complex minerals, such as loparite, a titanocolumbate, are known to occur in association with apatite deposits, which are being exploited on a very large scale.

United Kingdom.—Tantalum and columbium products are made by Blackwell's Metallurgical Works, Ltd., Liverpool, and Murex, Ltd., Rainham, Essex.

GALLIUM

Few elements exhibit so many spectacular physical properties as gallium, a silvery white metal about as heavy as iron. Having a melting point of only 29.75° C., a small piece of the solid metal held in the hand may be readily rendered molten through assimilation of body heat. In sharp contrast, the boiling point of gallium is remarkably high, being in the neighborhood of 2,000° C. Gallium metal is easily supercooled to temperatures substantially below its freezing point. Like water, gallium expands markedly upon freezing, and the resultant solid is less dense than the liquid metal. Because of its tendency to wet glass, in addition to its expansion upon freezing at near-room temperature, gallium metal is packaged commercially in cellophane bags and gelatine capsules which, in turn, are placed in rigid-type containers for added protection. Unlike mercury, liquid gallium has low vapor pressure over a wide range of temperatures and is nontoxic. Large orthorhombic crystals of gallium metal are readily grown and display startling differences in electrical resistivity and thermal expansion along the direction of their three crystallographic axes;[42] the ratios for electrical resistance and for the coefficients of thermal expansion were observed to be 1:3.2:7 and 31:16:11, respectively. The variation in resistivity is said to be greater than that known for any other metal. Crystals of gallium may be made to grow in any desired direction, according to the shape in which the original crystal is allowed to form. Long bars, which are actually single crystals, may be easily produced by crystallizing the metal in rubber tubes.

Production.—Rocky Mountain Research, Inc., Denver, Colo., was the only company reporting any gallium output for 1949; however, the metal or its compounds were probably also produced by the Donora Zinc Works of the American Steel & Wire Co., subsidiary of U. S. Steel Corp., Donora, Pa.[43] and by Saratoga Laboratories, Inc., Saratoga Springs, N. Y. In previous years gallium metal has been recovered by Aluminum Ore Co. (1946–48), subsidiary of Aluminum Co. of America, E. St. Louis, Mo.; Anaconda Copper Mining Co. (1943–45), Great Falls, Mont.; and Eagle-Picher Lead Co. (1946–48), Joplin, Mo. Demand for gallium in 1949 was negligible.

Most of the gallium produced domestically is derived in the process of extracting alumina from bauxite and from the smelting of zinc ores of the Tri-State district of Missouri, Kansas, and Oklahoma. Bauxite is reported to contain 0.002–0.008 percent Ga, and sphalerite in the Tri-State ores has been shown to assay from about 0.01–0.1 percent Ga, the lower figure being the general rule. Contrary to a widespread misconception, most of the gallium present in bauxite does not remain in the red-mud tailings, but, rather, is extracted along with the alumina from which it is separated on a batch basis, as demand may dictate. Ordinarily, however, no attempt is made to remove the gallium, the element ultimately ending in the final products, such as alumina or

[42] Powell, R. W., Some Anisotropic Properties of Gallium: Nature, vol. 164, No. 4160, July 23, 1949, pp. 153–154.

[43] Smith, G. T., and Moyer, R. C., Cadmium Recovery Practice at the Donora Zinc Works: Jour. Metals, vol. 1, No. 6, June 1949, pp. 360–363.

aluminum. The latter may contain about 0.01–0.02 percent Ga, which is not deleterious, however. The total gallium content of bauxite ore processed in the United States to make alumina, assuming a consumption of 2,000,000 short tons per year, would approximate 40 to 160 tons. In the absence of a low-cost continuous process for its routine recovery and, equally important, of large-scale demand for the metal, essentially all of this gallium will continue to be lost irretrievably. In the case of commercial recovery from the Tri-State zinc ores, gallium is removed, in part, by a preliminary chloridizing roast of the zinc sulfide concentrates, eventually finding its way to the cadmium-recovery plant, where it is finally extracted. (See the Germanium section of this chapter.) Where a chloridizing roast is not used on galliferous zinc ores which are smelted by the retort process, most of the gallium remains behind in the retort residues because of the element's relatively low volatility at the temperatures required for zinc distillation. Similarly, in the Waelz process for recovering zinc from retort residues, the gallium lags behind and is found in the slag, which may contain 0.01–0.05 percent Ga.

During 1949 the Bureau of Mines continued its search for domestic sources of gallium and studied means for its recovery from various raw materials, including gallium-rich residues formed in gas and coking plants.

Gallium is present in tin ores processed by the Government-owned tin smelter at Texas City, Tex., passing into the waste acid liquors and eventually into the "cements" discharged from the acid-reclamation plant.

Uses.—Aside from its familiar but very limited application in high-temperature thermometry, no uses have been developed for gallium yet that would require the element in any commercially significant quantity. The flurry of interest in gallium as a possible liquid-metal coolant in nuclear energy apparatus subsided almost completely as it became more generally known that excessive cost of the metal and unresolved technological difficulties probably obviated its use for this purpose. A gallium-nickel-silicon alloy was reported to show promise for dental fillings. The use of a radioisotope of gallium, Ga–72, for possible treatment of bone cancer was described. The element is injected in the form of gallium lactate, the radiogallium being concentrated selectively in the diseased portions of the bone, which are then bathed by its therapeutic rays.[44] Promising fields for gallium appear to lie in the electronics, phosphor, and fusible alloy industries.

Prices.—Gallium-metal quotations in 1949 were unchanged from the year previous, ranging from \$2.50–\$5.00 per gram, depending on quantities purchased.

World Review.—(See Germanium world review section of this chapter.)

GERMANIUM

Production.—Companies producing germanium metal and compounds in 1949 were the Eagle-Picher Lead Co., Joplin, Mo., and Saratoga Laboratories, Inc., Saratoga Springs, N. Y. The Donora

[44] Chemical and Engineering News, Gallium Isotope for Bone Cancer: Vol. 27, No. 25, June 20, 1949, p. 1819.

Zinc Works of the American Steel & Wire Co. (subsidiary of U. S. Steel Corp.), Donora, Pa., and the National Zinc Co., Bartlesville, Okla., produced germanium dioxide only. Output of germanium in 1949, almost all in the form of dioxide, was the highest on record and nearly 30 percent above 1948. Most of the germanium produced in the United States comes from the smelting of germanium-rich zinc ores mined in the Tri-State district of Missouri, Kansas, and Oklahoma; the zinc sulfide mineral in these ores contains about 0.01–0.1 percent Ge. The Bureau of Mines estimated Tri-State zinc-lead ore reserves as of December 31, 1947, at 66,100,000 short tons (based on a 1½-percent metal cut-off);[45] a corresponding recoverable content of zinc sulfide concentrates (60 percent Zn) was estimated at 2,402,433 tons. The germanium-metal content of such a quantity of concentrates would probably be between 240 and 2,400 tons. Reserve estimates covered only about 5 percent of the total areal extent of the district. The Eagle-Picher Co., largest producer of germanium, recovers the germanium, cadmium, and gallium contained in the zinc concentrates by means of a salt roast in the Dwight-Lloyd sintering process; the chloride of germanium, in particular, is readily volatilized and collected for further treatment.

Consumption and Uses.—Apparent consumption of germanium products, based upon producers' shipments, increased about 30 percent over 1948, being nearly identical to 1949 production. Germanium is consumed almost entirely by the electronics industry in making germanium diode crystal units, which are used for rectification of high-frequency currents, displacing certain types of vacuum tubes. A three-element unit holding great commercial promise, known as the transistor, is under intensive study in numerous private, Government, and Government-sponsored laboratories. Companies producing diodes and transistors are Sylvania Electric Products, Inc., Boston, Mass.; Kemtron, Inc., Beverly, Mass.; General Electric Co., Syracuse, N. Y.; Western Electric Division of Bell Telephone Co., Allentown, Pa.; and Raytheon Mfg. Co., Waltham, Mass. A tetrode, or four-element, germanium unit was described for which interesting commercial applications were claimed.[46]

Very little metallic germanium is purchased by electronics consumers, who prefer, instead, to buy the high-purity oxide and prepare their own metal from it. This situation exists, reportedly, because metal of high-enough purity is not yet available commercially. Essential, moreover, to the proper electronic function of germanium crystal units is the deliberate addition of minute traces of certain elements as impurities. Germanium (and silicon) may be made to carry electricity by conventional electron conduction (N-type) or by means of "positive" electrons (P-type); addition of trace impurities of nitrogen, phosphorus, antimony, or arsenic will form the N-type, and the P-type is produced by addition of boron, aluminum, gallium, or indium.[47] The quantity of impurity element required is so minute

[45] Ruhl, Otto, Allen, Simeon A., and Holt, Stephen P., Zinc-Lead Ore Reserves of the Tri-State District, Missouri-Kansas-Oklahoma: Bureau of Mines Rept. of Investigations 4490, 1949, 59 pp.

[46] American Metal Market, Germanium Crystal Development Outlined by Sylvania Researcher: Vol. 56, No. 120, June 22, 1949, p. 1.

[47] Lark-Horovitz, K., Conductivity in Semiconductors: Elec. Eng., vol. 68, No. 10, October 1949, pp. 865–872; vol. 68, No. 11, November 1949, pp. 937–942.

Scaff, J. H., Theurerer, H. C., and Schumacher, E. E., P-Type and N-Type Silicon and the Formation of the Photovoltaic Barrier in Silicon Ingots: Jour. Metals, vol. 1, No. 6, June 1949, pp. 383–388.

that its introduction may be brought about successfully through neutron bombardment and consequent transmutation of some of the germanium atoms within the crystal to atoms of gallium or arsenic. By shielding portions of such a crystal during irradiation and subjecting the separate portions to different treatment, germanium crystals may be formed in which the various segments have distinctly different electrical characteristics.[48] Such crystals will function photoelectrically and have practical possibilities in this field.

Germanium (and silicon) metal, in thickness up to several centimeters, will give appreciable transmission of infrared radiation over broad regions of the spectrum.[49] Lenses of the metal for industrial infrared work were reported being made at Purdue University, Lafayette, Ind.[50]

Stocks and Prices.—Producers' stocks of germanium dioxide, small at the end of 1948, declined about 15 percent by the 1949 year end. High-purity germanium dioxide was sold for $65–$70 per pound in 1949, about the same as in 1948; the average price of metal was about $330 per pound, showing an appreciable increase over 1948.

World Review.—Commercially important quantities of the germanium sulfide mineral, renierite, have been discovered in the Prince Leopold copper mine of the Union Minière du Haut-Katanga at Kipushi, Belgian Congo.[51] Samples of renierite have shown a germanium content ranging from 6.37 to 7.80 percent.[52] The company reports that a process for extracting the germanium has been perfected and that, provided reasonable notice is given to permit organizing for industrial production, it could supply important quantities of germanium metal.

The occurrence of germanium in coal and its combustion products has been the subject of many recent investigations, particularly within the United Kingdom[53] and Commonwealth countries.[54] British researchers found that flue dusts from high chimneys of the producer systems of gas works in the United Kingdom contain about 0.75 percent each germanium and gallium; most of this dust is lost, however, only a small proportion settling in the flues.

INDIUM

Indium is a silvery-white metal slightly heavier than iron and so soft it may be easily scratched with the fingernail. In nature the element is found only as traces, most usually in certain zinc, lead, tin, tungsten, and iron ores. As much as 0.1–1.0 percent In has been reported in sphalerite and 0.1 in stannite. Commercial production of indium comes principally as a byproduct of zinc and lead smelting and related chemical industries.

[48] Johnson, W. E., and Lark-Horovitz, K., Neutron-Irradiated Semiconductors: Phys. Rev., vol 76, No. 3, Aug. 1, 1949, pp. 442–443.
[49] Becker, M., and Fan, H. Y., Optical Properties of Semiconductors. II. Infra-Red Transmission of Germanium: Phys. Rev., vol. 76, No. 10, Nov. 15, 1949, pp. 1530–1531.
[50] Mining Journal (London), vol. 234, No. 5971, Jan. 27, 1950, p. 86.
[51] Vaes, J. F., [Renierite, a Germanium-Bearing Sulfide from the Prince Leopold Mine, Kipushi, Belgian Congo]: Ann. soc. géol. Belg., Bull. 72, 1948, pp. 19–32.
[52] Murdoch, Thomas G., Belgian Congo Annual Mineral Rept., Review of 1948: American Consulate, Elizabethville, Belgian Congo, Consular Rept. 18, July 23, 1949, p. 9.
[53] Reynolds, F. M., Occurrence of Vanadium, Chromium, and Other Unusual Elements in Certain Coals: Jour. Soc. Chem. Ind., vol. 67, No. 9, September 1948, pp. 341–345.
[54] Wilson, S. H., and Rothbaum, H. P., Spectrographic Determination of Gallium and Germanium in Ash of New Zealand Coals: Coal Research Committee, Dept. Scientific and Industrial Research, Wellington, N. Z., Rept. C. R. 248, January 1950, 6 pp.

Production.—The indium content of metal and compounds produced domestically in 1949 rose very considerably above the annual average for 1946–48, a period of negligible output, but still was far below that of 1941–45. Producers' shipments (indium content) in 1949 of 54,784 troy ounces were reminiscent of yearly movements during World War II and contrasted sharply with the 1946–48 average of only 11,926 troy ounces.

Producer and plant location:	*Products*
American Smelting & Refining Co., Denver, Colo., and Perth Amboy, N. J.	Indium metal and chemicals.
Donora Zinc Works, American Steel & Wire Co., (subsidiary U. S. Steel Corp.), Donora, Pa.	Indium metal.
Anaconda Copper Mining Co., Great Falls, Mont.	Do.
Cerro de Pasco Copper Corp., Brooklyn, N. Y.	Indium alloys of bismuth, tin, and other nonferrous metals.
Indium Corp. of America, Utica, N. Y.	Indium metal powder, sheet, wire, fabricated forms, alloys, chemicals, and plating solutions.
National Zinc Co., Bartlesville, Okla.	Indium metal.

Uses.—Indium finds its most important use as an unexcelled final plating for high-quality composite engine bearings, especially where high bearing loads, elevated operating temperatures, and severe conditions of lubricant corrosion are encountered. Indium solders are of growing importance. An indium-silver-lead composition is intermediate in applications between conventional low-melting solders and high-temperature brazing alloys. Indium-tin-lead solders containing 25 percent or more indium have notable resistance to corrosion by alkalies. A binary alloy with tin, marketed under the trade name Cerroseal-35, is finding wide application for making glass-to-glass and glass-to-metal seals; the alloy will also adhere to mica, glazed ceramics, and quartz and will solder metals bondable with standard lead-tin solders. (See Bismuth chapter of this volume for indium-bismuth alloys.)

Stocks and Prices.—Stocks of metal and compounds (indium content) held by producers at the 1949 year end declined 45 percent below 1948. The nominal quotation for 99.99 percent indium, first established in September 1945, has remained unchanged since that time. (Bismuth-indium alloy prices are given in the Bismuth chapter of this volume.)

World Review.—Consolidated Mining and Smelting Co. of Canada, Ltd., began production of 99.99 percent purity indium in 1949 at its Trail, B. C., works. Cerro de Pasco Copper Co., Oroya, Peru, is one of the world's largest indium producers. Peruvian output of indium in 1948 was 450,727 grams; production in 1949 was estimated at 645,449 grams.

LITHIUM

Production.—Producers are Maywood Chemical Works, Maywood, N. J., and Metalloy Corp. (subsidiary of Lithium Corp. of America), Minneapolis, Minn. Metalloy Corp. was engaged in expansion of production facilities in anticipation of enlarged demand for lithium

metal and compounds. (See Minor Nonmetals chapter of this volume for data on lithium minerals and compounds.)

Consumption and Uses.—Apparent consumption in 1949 of both lithium metal and alloys continued, as in 1948, at a level of a few thousand pounds.

Principal applications for lithium metal have centered around its use in the production of high-conductivity copper and copper-base alloys,[55] and as a starting point in the preparation of certain lithium compounds.

The alloys of magnesium and lithium have been intensively studied by the Navy Bureau of Aeronautics[56] and by private industry, notably the Dow Chemical Co., Midland, Mich. Addition of 10 percent by weight of lithium to magnesium exerts a profound effect, giving an alloy of appreciably greater ductility and workability as compared with lithium-free magnesium. On a strength-weight basis work-hardened magnesium-lithium alloys are comparable in yield and tensile strength to stainless steel type 301. Because of their extreme brittleness and instability at relatively low temperatures, further research is required before such alloys may be considered for structural applications.

Late in 1949 a great deal of publicity was given to the possibility of creating a thermonuclear atomic weapon. Lithium was frequently mentioned as a possible constituent of such a weapon, either in the form of lithium hydride or deuteride. These speculations were based upon the classic Cockcroft-Walton experiment, performed in the early 1930's, which demonstrated conclusively that a tremendous amount of energy is released when lithium atoms are bombarded with protons (hydrogen nuclei), giving rise to helium atoms as an end-product. Although a core of U–235 or plutonium would apparently be needed for detonation, the theoretical energy released in the resulting nuclear combination of lithium and hydrogen would, on the basis of equivalent weight, be over double that released in the complete fission of U–235 or plutonium.[57] The unstable heaviest isotope of hydrogen, tritium, has also received prominent mention in connection with thermonuclear reactions. Tritium is produced by bombarding the lithium isotope, Li–6, with neutrons.[58] Hydrogen deuteride gas is prepared in high-purity form through the interaction of heavy water with lithium aluminum hydride.[59] Stable lithium isotopes (Li–6, and Li–7), lithium deuteride, lithium aluminum deuteride, deuterium gas, tritium gas, deuterium oxide (heavy water), and tritiated water are available through the Oak Ridge, Tenn., isotope-distribution center of the Atomic Energy Commission. Lithium hydride and lithium-aluminum hydride are produced by Metal Hydrides, Inc., Beverly, Mass.

[55] Landolt, P. E. and Pyne, F. B., Use of Lithium Cartridges: Foundry, vol. 77, No. 3, March 1949, pp. 90–91, 262, 263.
Baker, W. A., and Hallowes, A. P. C., Elimination of Bismuth Embrittlement in Coppers: Engineering, vol. 168, No. 4367, Oct. 7, 1949, pp. 379–380.
[56] Jackson, J. H., Frost, P. D., Loonam, A. C., Eastwood, L. W., and Lorig, C. H., Magnesium-Lithium Base Alloys—Preparation, Fabrication and General Characteristics: Jour. Metals, vol. 1, No. 2, February 1949, pp. 149–168.
[57] Chemical Age (London), Nuclear Fission of LiH: Vol. 62, No. 1594, Jan. 28, 1950, p. 156.
[58] Seligman, Henry, Application of Radio-Isotopes in Industry: Chem. and Ind., No. 20, May 14, 1949, p. 312.
[59] Wender, Irving, Friedel, R. A., and Orchin, Milton, Preparation of High-Purity Hydrogen Deuteride from Lithium Aluminum Hydride: Jour Am. Chem. Soc., vol. 71, No. 3, March 1949, p. 1140.

Prices.—Quotations for lithium metal in E&MJ Metal and Mineral Markets in 1949 opened the year at $15 per pound for metal of 98–99 percent purity. On June 9 the same figure was quoted, but for 98-percent grade only, and on September 15, the quotation fell to $9.85–$11.00 per pound, depending on quantity.

Canada.—Northern Chemicals, Ltd., engaged in developing spodumene deposits northeast of Winnipeg, Manitoba, during 1949; the company plans to establish a plant, possibly in Winnipeg, for producing lithium metal and compounds. (See Beryllium, world review discussion in this chapter.)

SELENIUM AND TELLURIUM

In nature, selenium and tellurium characteristically occur in copper sulfide and gold ores. Commercially, the elements are recovered, for the most part, from anode slimes accumulated in the electrolytic refining of blister copper. Noticeable quantities of selenium are present in the sedimentary uranium-vanadium ores at numerous localities in the Colorado Plateau. Attempts have been made in recent years to recover this selenium, which is otherwise lost in the vanadium-roaster stack gases.

Production.—Domestic selenium output in 1949 amounted to 468,502 pounds. Total United States production for the 10-year period 1939–48 was 4,627,201 pounds, the peak annual output being reached in 1943 when 635,581 pounds were recorded. Tellurium production in 1949 was 109,021 pounds, rising for the third successive year; the increase over 1948 was a notable 123 percent, however, there was no correlation between production and apparent demand. Tellurium output in the United States for 1939–48, inclusive, reached 863,395 pounds; the maximum production for any one year totaled 224,639 pounds in 1941.

Selenium and tellurium and their compounds are produced by the American Smelting & Refining Co., Baltimore, Md.; United States Metals Refining Co. (Chrome), Carteret, N. J.; and International Smelting & Refining Co., Perth Amboy, N. J. Tellurium and compounds are recovered from lead bullion by the United States Smelting, Refining & Mining Co., East Chicago, Ind.

Salient statistics of elemental selenium and tellurium in the United States, 1940–44 (average) and 1945–49, in pounds

Year	Selenium					Tellurium		
	Production	Producers' shipments [1]	Producers' stocks at end of year	Imports [2]		Production	Producers' shipments [1]	Producers' stocks at end of year
				Pounds	Value			
1940–44 (average)	515,335	462,531	333,519	119,098	$185,188	131,918	107,072	100,862
1945	458,486	604,445	371,258	216,793	395,934	89,750	60,328	183,527
1946	291,103	405,226	257,135	475,081	806,205	3,765	38,523	148,769
1947	512,648	489,415	280,368	529,175	893,171	45,248	71,300	122,717
1948	561,156	570,718	270,806	267,118	489,762	48,806	78,788	92,735
1949	468,502	317,960	334,067	171,581	317,145	109,021	64,278	135,605

[1] Bureau of Mines not at liberty to publish values.
[2] Includes selenium salts.

Consumption and Uses.—Apparent consumption (producers' domestic shipments plus imports) of selenium and tellurium in 1949 was 489,541 and 64,278 pounds, respectively, representing declines of 42 and 18 percent below 1948 figures.

Selenium is consumed principally in the glass, rubber, pigment, and electronics industries. Tellurium is much less important and limited in application. Principal uses are as an iron-foundry corewash for chill inducement and as an alloying agent in making tellurium-lead and tellurium-copper.

Stocks.—Producers' year-end stocks in 1949 rose 23 percent for selenium and 46 percent for tellurium as compared to the same period in 1948.

Prices.—Trade-journal quotations for selenium black and for tellurium in 1949 were $2.00 and $1.75 per pound, respectively, the same prices that prevailed in 1948.

Foreign Trade.—Imports for consumption of selenium and salts in 1949 came almost wholly from Canada, which country accounted for 170,354 pounds, valued at $316,771. There were no imports of tellurium or its compounds. Data on exports of selenium and tellurium are not available.

World Review.—Production of selenium in Canada closely parallels that of the United States in magnitude. Canadian production of selenium and tellurium in the period 1939–48, inclusive, totaled 3,698,578 and 85,180 pounds, respectively. In 1949 392,600 pounds of selenium, valued at C$804,830, and 52,700 pounds of tellurium, valued at C$94,860, were produced in Canada. Comparative figures for 1948 were, for selenium, 390,894 pounds (value C$781,788) and, for tellurium, 11,425 pounds (value C$19,994). In Canada, selenium and tellurium are recovered at the electrolytic copper refineries of the International Nickel Co. of Canada, Ltd., Copper Cliff, Ontario, and of Canadian Copper Refiners, Ltd., Montreal East, Quebec. The first-mentioned refinery has a proved capacity of 270,000 pounds of selenium a year; the plant of Canadian Copper Refiners, Ltd., with a production capacity of 450,000 pounds a year, is believed to be the largest in the world. At Copper Cliff, selenium is recovered from the Sudbury copper-nickel ores. The Montreal East operation extracts the element from copper anodes produced from the copper–gold ores of Noranda, Quebec, and from blister copper derived from the copper-zinc ores of Hudson Bay Mining & Smelting Co., Ltd., Flin Flon, Manitoba. The latter company reported selenium production from its own ores and purchased concentrates as 143,615 and 138,597 pounds in 1949 and 1948, respectively. Sales of selenium and tellurium in 1949 by the International Nickel Co. of Canada, Ltd. were 117,636 and 9,191 pounds. Consumption of tellurium metal in Canada, by steel and white metal foundries, in 1940–48, inclusive, was reported as 7,486 pounds.[60]

Selenium is produced in the Soviet Zone of Germany by the publicly owned operation Mansfeld Kupferbergbau und Hüttenwerke.

[60] Dominion Bureau of Statistics, Department of Trade and Commerce, Miscellaneous Metals Industry, 1948, pp. 16-17.

THALLIUM

Thallium is recovered commercially from residues accumulated in certain plants producing zinc and cadmium metal and chemicals, sulfuric acid, and white arsenic.

Production.—The American Smelting & Refining Co. is the sole domestic producer of thallium. Output in 1949 came from newly constructed recovery units located in the company cadmium refinery, Denver, Colo., and in its silver-lead smelter at Murray, Utah. In the latter operation, thallium was extracted from crude white-arsenic Cottrell dusts; this facility was shut October 1, 1949, along with the general closure of the Murray smelter. The completely new and much-enlarged thallium-recovery unit at the Globe smelter, which had been under construction in 1948, began operation early in 1949.

The arsenical gold ores at Mercur, Utah, are rich in thallium and probably constitute the largest domestic reserve of the element. Owners estimated the thallium content of old cyanide tailings dumps to exceed 4,000,000 pounds, with over 10 times that quantity in the unbroken ores.

Consumption and Uses.—The producer's shipments of both metal and thallium sulfate in 1949 were a few percent above 1948, suggesting a possible small rise in consumption. The principal application for thallium has been in the form of the sulfate, which is used as the active agent in some rodent poisons. Competition from organic rodenticides continued to be important; however, thallium preparations reportedly held a strong market position because of certain highly desirable specific toxic effects and the disinclination of rodents to develop an aversion to them. A possible important future bulk use of thallium is in the form of bromoiodide crystals in connection with infrared signal transmission in military and in research devices. The National Bureau of Standards was actively engaged throughout 1949 in the growth of such crystals; Harshaw Chemical Co., Cleveland, Ohio, produces thallium bromoiodide crystals on a commercial basis.

Prices.—The American Smelting & Refining Co. quoted thallium metal 99.9 percent, 10-pound lots, at $15 per pound until September 1949 and at $12.50 thereafter. The sulfate quotation was $15 until September, dropping to a figure of $10.50 for the remainder of the year.

World Review.—Certain of the Upper Silesian lead-zinc ores of Poland are noteworthy for their high thallium content. Hudson Bay Mining & Smelting Co., Flin Flon, Manitoba, Canada, accumulates thallium-rich residues from its base-metal smelting operations.

ZIRCONIUM AND HAFNIUM

Mine Production.—Almost the entire domestic zircon output in 1949 was accounted for, as in every year since April 1944, by the Rutile Mining Co. of Florida, South Jacksonville, Fla.; zircon is recovered as a coproduct with ilmenite and rutile concentrates. A very small 1949 production of zircon came from the Florida Ore Processing Co. works near Melbourne, Fla. The new titanium-

mineral plant of E. I. du Pont de Nemours & Co., near Starke, Fla., from which very large quantities of zircon will ultimately be derived, began operations early in 1949; the planned intake capacity of 25,000 tons of sand per day was approached late in the year. Unforeseen obstacles encountered, within the sand deposit, such as coarse organic debris (logs and roots), and excessively hard layers of sediments which required blasting, seriously hampered dredging operations. Functioning of the concentrating plant (Humphrey spirals), aside from being affected by intermittent sand feed, was complicated by the presence of tanninlike substances which so darkened the mill water that excessively wide cuts were required on the spirals to prevent undue loss of titanium minerals; the grade of concentrate suffered as a consequence. Clogging of mill screens by roots also caused serious difficulty and, finally, discharge of the dark mill effluent into streams aroused local protest.

The du Pont plant is operated under contract by the Humphreys Gold Corp.; zircon is contained in the tailings from the operation which are being impounded with a view to its subsequent removal. The Humphreys Gold Corp. is reported to have constructed nearby a small plant for the zircon recovery which will be undertaken when market conditions for the mineral improve. Any zircon recovered will, by agreement, be for the account of Humphreys Gold Corp.

Titaniferous black sands containing important quantities of zircon are extensively distributed through central and northeastern Florida from northeast of Jacksonville to northwest of Lake Okeechobee, according to a Bureau of Mines report.[61] Zircon is abundant in the gold-monazite gravels flanking the granite areas of central Idaho and, with the gradual development of monazite recovery in that region, may eventually be producible in significant tonnage. Freight rates to eastern consumers would be prohibitive, at any price paid for zircon concentrates to date; consequently, western consuming centers probably would have to be developed. Zircon is also abundant in central California gold gravels and may likewise eventually be recovered commercially.

There seemed little doubt that by the end of 1949 the United States had achieved a position of self-sufficiency with respect to zircon, possibly well over any domestic requirements yet reached. That this favorable situation developed only incidentally to the exploitation of the sand deposits for their titanium contents serves to emphasize the importance of maintaining a stable titanium mineral industry in Florida.

Refinery Production.—Companies and others producing zirconium metal, alloys, compounds, and refractories and hafnium metal and compounds are as follows:

[61] Thoenen, J. R., and Warne, J. D., Titanium Minerals in Central and Northeastern Florida: Bureau of Mines Rept. of Investigations 4515, 1949, 62 pp.

Organization and plant location:	Products
American Electro Metal Corp., Yonkers, N. Y.	Zirconium boride (experimental).
F. W. Berk & Co., Woodridge, N. J.	Miscellaneous zirconium compounds; ground zircon.
Beryllium Corp., Reading, Pa.	Zirconia.
Cooper Metallurgical Associates, Cleveland, Ohio.	Zirconium boride and carbide.
Corhart Refractories Co., Louisville, Ky.	Baddeleyite and zircon refractories.
De Rewal International Rare Metals Co., Philadelphia, Pa.	Hafnium metal and compounds.
Dow Chemical Co., Midland, Mich.	Magnesium alloys containing zirconium (ZK-60, EK-30).
Electro Metallurgical Division, Union Carbide & Carbon Corp., Niagara Falls, N. Y.; Alloy, W. Va.; Sheffield, Ala.	Zirconium-ferrosilicon (12-15% Zr, 35-40% Zr), CMSZ (0.75-1.75% Zr), SMZ (5-7% Zr), Silcaz (3-5% Zr), nickel-zirconium.
Fairmount Chemical Co., Newark, N. J.	Hafnium compounds.
Foote Mineral Co., Philadelphia, Pa.	Zirconium metal (including iodide-process) and compounds, ground zircon.
Metal Hydrides, Inc., Beverly, Mass.	Zirconium metal, zirconium hydride, zirconium nitride; numerous binary alloys of zirconium with ferrous and nonferrous metals.
Norton Co., Worcester, Mass.	Fused stabilized-zirconia refractories.
Rohm & Haas Co., Philadelphia, Pa.	Zirconyl sulfates.
Titanium Alloy Mfg. Division, National Lead Co., Niagara Falls, N. Y.	Zirconium metal (sodium or magnesium reduced), zirconium-aluminum alloys, zirconium compounds, ground zircon, stabilized-zirconia refractories.
United States Atomic Energy Commission, Oak Ridge, Tenn.	Zirconium and hafnium radioisotopes Zr-95, Hf-181.
Bureau of Mines, Albany, Oreg.	Zirconium metal (magnesium reduced).
Westinghouse Electric Corp., Pittsburgh, Pa.	Zirconium metal (calcium reduced)—experimental.

The Rohm & Haas Co. curtailed some of its zirconium activities in 1949, discontinuing the manufacture of zirconia enamel opacifier; however, it continued active in production of zirconium tanning compounds and other items. F. W. Berk was reported as nearing production of zirconia, potassium zirconium fluoride, and various ceramic and refractory materials.[62] Beryllium Corp. has in years before 1949 produced zirconium-copper and zirconia refractories; the company reports that it has a fully equipped facility for production of zirconium compounds which is being kept in stand-by condition. Upon completion of its expanded pilot plant at Albany, Oreg., in 1949, Bureau of Mines production of ductile zirconium metal increased sharply over that reported in 1948.[63] Efforts continued to produce hafnium-free metal. Interest was reported on the part of the Atomic Energy Commission, the Navy, and other Government agencies.

Consumption and Uses.—Domestic zircon consumption in 1949 is estimated to have been around 20,000 tons, declining about 20 percent below 1948. Percentage distribution of zircon consumed by

[62] Chemical Industries, vol. 64, No. 2, February 1949, pp. 207-208.
[63] Steel, vol. 125, No. 2, July 11, 1949, p. 72.

industry in recent years, according to general fields of use, is reported to be approximately as follows: Ceramics (except refractories), 32; refractories, 20; oxides and chemicals, 20; foundry sand, 16; and alloys, 12. Producers' shipments of zirconium alloys in 1949 halved those for 1948.

Zirconium metal, particularly in its ductile form, has been the object of much recent attention.[64] Because of the nearly identical methods used for producing zirconium and titanium metals and, further, because of the close association of their minerals in many commercial deposits, development of the technology of the two metals has shown a close parallel. Unlike titanium, however, which evidences great promise as a structural metal, zirconium appears to stand out most notably because of its superior corrosion resistance and ready workability. In resistance to hydrochloric acid corrosion, zirconium is close behind tantalum and far superior to the latter in resistance to caustics, being unaffected by molten caustic soda. Thus, the most likely future applications for ductile zirconium metal appear to be, like tantalum, in the chemical industry. Again, like tantalum, zirconium is unaffected by body fluids, hence should find many uses in the surgical field in the form of plates, wire, and gauze.

The fact that zirconium metal has a very low tendency to absorb slow neutrons, combined with a relatively high melting point (1,860° C.) and its ease of formability and corrosion resistance, have made it a material of much interest in the field of atomic energy. It seems apparent that its use in place of aluminum for the jackets that house the uranium-metal slugs in present-day atomic piles would permit operation at temperatures well above the melting point of aluminum, which is now presumably a limiting factor.[65] Almost all zirconium metal produced to date has contained about 2 percent of the element, hafnium, which is so closely akin to zirconium chemically as to make its separation on a practical scale exceedingly difficult; nonetheless, its separation is mandatory, for the slow neutron-absorption tendency of hafnium is very high. Pure hafnium metal appears to have formability, corrosion resistance, and a high melting point, similar to zirconium; this set of properties, combined with its aforementioned nuclear characteristics, suggests its possible value as a material for protective shielding. Other metals, notably those in the platinum group, have roughly similar properties, but only hafnium would conceivably be obtainable in ton quantities and from readily available raw materials should demand warrant.

Nonductile zirconium has been available in quantity for many years and has found use principally in powder form as a pyrophoric substance in flashlight powders and flares. Lighter flints made from lead, impregnated with zirconium powder,[66] are alleged to have intense sparking properties and may possibly become competitive with conventional ferrocerium flints; however, it is reported that certain difficulties involved in their quantity production and use have yet to be resolved.

[64] Jaffee, R. I., Zirconium Metal, as of 1949: Jour. Metals, vol. 1, No. 7, pp. 6-9.

[65] Cockroft, Sir John D., Metallurgical and Mining Problems in Atomic Energy: Mining Jour. (London), vol. 233, No. 6952, pp. 857-860.

[66] Anicetti, Robert J. (assigned to Metal Hydrides, Inc.) Pyrophoric Alloy of Zirconium, Lead, and Titanium and Sparking Device Containing the Same: U. S. Patent 2,490, 571, Dec. 6, 1949; and Pyrophoric Alloys of Lead and Zirconium and Sparking Devices Containing the Same: U. S. Patent 2,490,570, Dec. 6, 1949.

Zirconium is important in certain steel making, ordinarily being added in the form of zirconium-ferrosilicon alloy; its function is that of a powerful deoxidizer, degasifier, and grain refiner, zirconium-treated steels being particularly suitable for tools subject to violent stresses, such as rock drills.

Zirconium has a strong affinity for sulfur and may be used to reduce hot shortness in high-sulfur steel and for the production of nodular cast irons in a manner similar to cerium and magnesium. The low-zirconium alloys CMSZ and SMZ are added to cast iron to promote density, machinability, and strength. Silcaz (3 to 5 percent Zr) acts as an intensifier in the preparation of boron steels. The zirconium content of various steel or cast-iron products containing the element is reported to range from less than 0.05 to 0.20 percent Zr.

In the field of magnesium alloys, zirconium is rapidly becoming of great importance; zirconium has a greater grain-refining effect on magnesium than any other metal and furthermore, confers better workability, strength, and toughness.[67] The extrudable alloy ZK–60 (0.6 percent Zr and 6.0 Zn) is reported being used as floor beams in the Douglas DC–6 airplane, and designers have given consideration to the use of ZK–60 in the construction of a proposed all-magnesium airplane. Zirconium is an essential constituent of EK–30 alloy, now employed extensively in military aircraft. (See Cerium and Other Rare-Earth Metals section of this chapter.)

Zircon is widely employed as an acid-type refractory, being especially useful in linings for glass[68] and aluminum melting furnaces. Zircon has been used as an ingredient (20–60 percent) of high-temperature porcelains for many years because of its thermal shock resistance.[69]

Baddeleyite, like zircon, is very important as a glass-furnace refractory; its use in production of ferrozirconium alloys is reportedly being supplanted in large part by zircon. Zirconia, the chemically prepared oxide, has valuable properties as a refractory when stabilized with small additions of lime or magnesia.[70] In fused form, stabilized zirconia is reported to have made practicable the continuous casting of steel; liners of the material are said to be in use, or contemplated for use, in oil refineries and synthetic gasoline plants, presumably in the catalytic cracking towers or high-temperature reaction chambers.

Large quantities of unstabilized zirconia are employed as a glaze and porcelain opacifier. Other commercial applications of zirconium compounds are in high-duty dielectrics (alkaline-earth zirconates), organic chemical catalysts (zirconia gel), textile water repellents (zirconium acetate), tanning agents (zirconyl sulfates) and special refractories (zirconium nitride and zirconium boride).

Stocks.—In 1949 industry year-end stocks of zircon concentrates (65 percent ZrO_2), including some baddeleyite, were about 8,700 short

[67] Ball, C. J. P., Magnesium-Zirconium Alloys: Metal Ind. (London), vol. 75, No. 8, Aug. 19, 1949, pp 152–153.

[68] Knauft, R. W., Bonded Refractories for Special Purposes I, II: Glass Ind., vol. 30, Nos. 8 and 9, August and September 1949, pp. 433–440, 460, 497–499, 522.

Stott, V. H. and Hilliard, A., Zircon Refractories: Trans. British Ceram. Soc., vol. 48, 1949, pp. 133–139.

[69] Industrial and Engineering Chemistry, vol. 41, No. 10, October 1949, p. 2103.

Bartlett, Helen B., and Schwartzwalder, Karl, Trends in the Chemical and Mineralogical Constitution of Spark Plug Insulators: Am. Ceram. Soc. Bull., vol. 28, No. 11, Nov. 15, 1949, p. 470.

Schleicher, H. M., Carteret Zircon—a Versatile Ceramic: Cer. Age, vol. 53, No. 4, April 1949, pp. 200–201.

Luttrell, Carolyn Banks, Glazes for Zircon Porcelains: Jour. Am. Ceram. Soc., vol. 32, No. 10, Oct. 1, 1949, pp. 327–332.

[70] Whittemore, Jr., O. J., Properties and Uses of Pure Oxide Heavy Refractories: Jour. Am. Ceram. Soc., vol. 32, No. 2, Feb. 1, 1949, pp. 48–53.

tons as compared to 6,500 for 1948. Mixed zircon-rutile concentrate stocks fell to only 300 tons (zircon content, 250 tons); comparable figures for 1948 and 1947 were, respectively, 5,700 tons (zircon content 4,100) and 12,600 (zircon, 9,300). Both zircon and baddeleyite are included on the strategic materials list of the National Stockpile.

Prices.—E & MJ Metal and Mineral Markets quoted zircon concentrate (65 percent ZrO_2), c. i. f. Atlantic ports, at $45–$48 per ton at the beginning of 1949; declines were noted to $42–$45 on May 26, and to $40–$45 on December 22. Generally lower consumer demand and large zircon stocks held by producers and consumers alike contributed toward the lowering of zircon prices. Trade-journal quotations on zirconium metal, alloys, and compounds showed no change from 1948.

Foreign Trade.—Before March 1948, the United States had received most of its zircon imports from Australia, the principal foreign supplier, in the form of mixed zircon-ilmenite-rutile-monazite concentrates. Thereafter, the Australian Government banned the export of mixed concentrates containing 0.5 percent, or more, of monazite because of its desire to conserve the latter mineral for possible atomic energy use. Mixed sands may still be shipped, however, provided the monazite content is under 0.5 percent. Thus, about 5,500 tons of mixed Australian zirconiferous sands were received by the United States in 1949. The Commonwealth Government, however, reportedly does not favor even this export of mixed sands because of the lower net dollar return as compared with concentrates of the separated component minerals, zircon, rutile, and ilmenite.

Exports of zirconium ore and concentrates went principally to Canada in 1949; total for all countries was 305 tons, valued at $23,654; total shipments in 1948 and 1947 were 312 and 330 tons, respectively. Export shipments of zirconium metal and alloys in 1949 were 74,346 pounds, value $12,942; Canada and the United Kingdom received the bulk, 51,639 and 22,452 pounds, respectively. Comparable total shipment figures for previous years were: 1948, 21,966 pounds; 1947, 9,592; and 1946, 2,377.

Zirconium ore (concentrates)[1] imported for consumption in the United States, 1945–49, by countries, in short tons

[U. S. Department of Commerce]

Year	Australia[2]	Brazil	Canada	French West Africa (Senegal)	India	Total: Short tons	Total: Value
1945	25,672	792	----------	6	----------	26,470	$554,400
1946	14,379	2,431	4	----------	----------	16,814	453,458
1947	21,894	4,619	3	----------	4,181	30,696	891,161
1948	[3] 14,320	3,553	2	----------	279	[3] 18,154	[3] 571,161
1949	18,839	1,994	----------	----------	----------	20,833	636,529

[1] Concentrates from Australia are zircon or mixed zircon-rutile-ilmenite, and those from Brazil are baddeleyite or zircon. All other imports are zircon.

[2] Imports of zircon, rutile, and ilmenite from Australia until early 1948 were largely in the form of mixed concentrates. These mixed concentrates are classified by the U. S. Department of Commerce arbitrarily as "zirconium ore," "rutile," or "ilmenite." Total zircon contents of the "zirconium ore" (as shown in this table) and of the "rutile" and "ilmenite" concentrates (see Titanium chapter) are estimated as follows: 1945, 17,138 tons; 1946, 11,535 tons; 1947, 22,727 tons; 1948, 13,873 tons; and 1949, 14,623 tons.

[3] Revised figure.

WORLD REVIEW

Australia.—Although outstripped by the United States in 1949 from the standpoint of potential productive capacity, Australia has been the world's largest producer of zircon during most of the period from the mid-1930's to date. By 1948 the Australian industry was reported equipped to produce 26,000 long tons of zircon a year.[71] Zircon Rutile, Ltd., the largest Australian producer of black-sand concentrates, stated in its annual report of midyear 1949 that the market for company products, which had been quiet in late 1948, gradually deteriorated in the first half of 1949.[72]

Consumers in the United States constitute the principal market for Australian zircon. American buyers were reluctant to foreorder in 1949 because of development of deposits of heavy minerals in Florida, the trade recession, and overlarge inventories. National Titanium Pigments, Ltd. (subsidiary of Laporte Chemicals, Ltd.), in the United Kingdom was reported acquiring an interest in Zircon Rutile, Ltd. The latter concern would supply the raw materials needed for the manufacture of chemical products in Australia. The possibility of producing zirconium sulfate was being investigated.[73] In 1948 large-scale prospecting was conducted by a subsidiary of the Barrier zinc companies, Titanium & Zirconium Industries Pty., Ltd.; reserves of zircon on North Stradbroke Island, Queensland, were reported comparable to those of Trail Ridge, Fla., in the United States. In 1949, the company undertook construction of a sand treatment plant on Stradbroke Island incorporating Humphrey Spirals, a Dutch State Mines Cyclone, and magnetic and electrostatic separators.[74]

United Kingdom.—Zirconium alloys of the ferrous and nonferrous metals are made by Blackwell's Metallurgical Works, Ltd., Liverpool, and by Murex, Ltd., Rainham, Essex. The latter company also produces zirconium metal and hydride. Zirconium compounds are made by Imperial Chemical Industries, Ltd., Liverpool.

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[71] Mead, G. F., Zirconium: Australian Mineral Industry 1948 Review (Commonwealth of Australia, Dept. of Supply and Development, Bur. of Mineral Resources, Geology, and Geophysics), 1949, pp. 138-149.

[72] Industrial and Mining Standard, vol. 104, No. 2659, Oct. 6, 1949, p. 34.

[73] Industrial and Mining Standard, vol. 104, No. 2660, Oct. 20, 1949, p. 19.

[74] Dunkin, H. H., Australian Research in Mining and Metallurgy: Ind. and Min. Standard, vol. 104, No. 2659, Oct. 6, 1949, p. 20.

Minor Nonmetals

By D. G. Runner and J. C. Arundale[1]

GRAPHITE

PRODUCTION and sales of domestic graphite in 1949 were substantially lower than in 1948. Production of crystalline and amorphous graphite amounted to 6,102 short tons, and shipments were estimated at 5,213 tons valued at $475,264. The manufacture of artificial graphite continued to increase, but the Bureau of Mines is not at liberty to publish detailed figures for this type of graphite. There are too few domestic producers to allow publication of separate statistics on natural crystalline and amorphous graphite. However, the accompanying table shows combined figures for 1945–49.

Two reports covering investigations of graphite deposits in New York and Pennsylvania have been released.[2]

Production and shipments of natural graphite in the United States, 1945–49

Year	Production (short tons)	Shipments: Short tons	Shipments: Value	Year	Production (short tons)	Shipments: Short tons	Shipments: Value
1945	4,888	5,334	$289,207	1948	9,949	9,871	$450,759
1946	5,575	4,844	252,596	1949	6,102	[1] 5,213	475,264
1947	4,387	5,207	221,260				

[1] Partly estimated.

Consumption.—Although the coverage of the graphite consumption canvass is incomplete, the totals obtained indicate at least the minimum quantities of graphite used in making various products. The 1949 totals for the various uses are as follows:

Consumption of natural graphite in the United States in 1949, by uses

Use	Short tons	Value	Use	Short tons	Value
Foundry facings	5,525	$397,031	Paints and polish	186	$11,567
Batteries	2,626	131,222	Packings	178	68,343
Lubricants	2,290	393,035	Retorts	96	22,167
Crucibles	2,035	447,047	Bearings	22	9,222
Stoppers, sleeves, and nozzles	912	158,726	Other[1]	1,587	514,743
Pencils	845	584,939	Total	16,302	2,738,042

[1] Includes brake lining, carbon brushes, electrodes, etc.

[1] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[2] Millar, W. T., and Sanford, Robert S., Investigation of Suffern Graphite Deposits, Rockland County, N. Y.: Bureau of Mines Rept. of Investigations 4438, 1949, 6 pp.

Sanford, Robert S., and Lamb, Frank D., Investigation of the Benjamin Franklin Graphite Mine (Government-Owned) and the Just Graphite Mine, Chester County, Pa.: Bureau of Mines Rept. of Investigations 4530, 1949, 17 pp.

Prices.—Quotations for graphite were fairly stable during 1949, and at the year end the trade-journal listings were as follows, f. o. b. New York: Madagascar, c. i. f., New York, standard grades, 85 to 87 percent carbon, $210 per ton; special mesh, $265–$300; special grade 99 percent carbon, $700. Amorphous graphite, Mexican, f. o. b. point of shipment (Mexico), per metric ton, $9–$16, depending on grade.

Foreign Trade.—As shown in the accompanying table, imports of all types of graphite in 1949 declined sharply from the total of 1948. The imports amounted to 31,805 short tons valued at $1,260,467—a decrease of 39 percent in quantity and 38 percent in value from the 1948 figures. Quantitywise, natural amorphous shows the greatest change, decreasing from 48,150 tons valued at $1,529,312 in 1948 to 29,298 tons valued at $954,388 in 1949. This drop in total imports was caused largely by decrease in imports from Mexico.

Graphite (natural and artificial) imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

	Crystalline				Amorphous				Total	
	Flake		Lump, chip, or dust		Natural		Artificial			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	2,883	$286,532	5,207	$558,242	28,042	$569,600	154	$6,223	36,286	$1,420,597
1946	3,337	253,163	56	7,990	29,743	1,065,835	4	558	33,140	1,327,546
1947	2,730	255,556	198	16,325	40,703	1,236,734	28	2,660	43,659	1,511,275
1948										
Brazil	2	173							2	173
Canada	364	52,134	(1)	1	1,576	132,217	117	4,153	2,057	188,505
Ceylon			532	78,967	[2] 5,198	676,107			[2] 5,730	755,074
France	99	37,210	22	4,237					121	41,447
French Morocco					55	2,502			55	2,502
India					[2] 137	16,703			[2] 137	16,703
Korea					29	565			29	565
Madagascar	[2] 3,031	340,040							[2] 3,031	340,040
Mexico					41,043	693,637			41,043	693,637
Mozambique					78	4,960			78	4,960
Norway					34	2,621			34	2,621
United Kingdom			(1)	21					(1)	21
Total	[2] 3,496	429,557	554	83,226	[2] 48,150	1,529,312	117	4,153	[2] 52,317	2,046,248
1949										
Canada	333	54,252			1,455	136,541	44	1,398	1,832	192,191
Ceylon			235	27,293	2,485	348,299			2,720	375,592
Colombia					56	6,032			56	6,032
Finland					6	200			6	200
France	16	7,525							16	7,525
Germany	33	7,041							33	7,041
India			(1)	20	168	30,654			168	30,674
Korea					62	2,776			62	2,776
Madagascar	1,846	208,550							1,846	208,550
Mexico					24,893	417,982			24,893	417,982
Mozambique					173	11,904			173	11,904
Total	2,228	277,368	235	27,313	29,298	954,388	44	1,398	31,805	1,260,467

[1] Less than 1 ton.
[2] Revised figure.

The United States tariff rates on graphite, effective January 1, 1948, were still in force during 1949. They are: Amorphous natural and artificial, 5 percent ad valorem; crystalline flake, 15 percent ad valorem, with a specific minimum of 0.4125 cent per pound and a specific maximum of 0.825 cent per pound; crucible flake and dust and other crystalline lump and chip 7½ percent ad valorem.

Exports of natural graphite, 1945–49, were: 1945, 1,308 tons, $134,414; 1946, 2,313 tons, $267,137; 1947, 1,546 tons, $171,607; 1948 (revised figures), 1,047 tons, $127,931. Data for 1949 are shown in an accompanying table.

Graphite exported from the United States in 1949 [1]

[U. S. Department of Commerce]

Country	Amorphous		Crystalline flake, lump, or chip		Natural, n. e. s.	
	Short tons	Value	Short tons	Value	Short tons	Value
Austria	2	$488			(2)	$225
Belgium-Luxembourg	1	216				
Bolivia			1	$112		
Brazil			3	893		
Canada	120	6,941	10	4,812	729	59,986
Chile	4	843	20	3,918		
Colombia	1	235			3	450
Cuba	7	1,115	25	3,687	9	894
Czechoslovakia	67	10,759				
Denmark			(2)	103		
French Indochina	9	1,516				
Germany	43	5,979				
Greece			4	562		
Guatemala			1	201		
Honduras			(2)	103		
Hong Kong	28	3,280				
Indonesia	19	2,051	2	492		
Italy	35	12,732	2	1,077		
Jamaica			1	217		
Mexico	5	1,729	16	2,893	34	2,934
Netherlands	23	3,602	1	230		
Netherlands Antilles			(2)	108		
Peru			1	189		
Philippines	11	1,576	4	937	4	587
Portugal	7	1,103				
Saudi Arabia			(2)	100		
Sweden	16	2,634				
Switzerland	11	1,560				
Turkey					1	544
United Kingdom	49	8,800			18	4,271
Uruguay			1	186		
Venezuela			2	464	2	360
Total	458	67,159	94	21,284	800	70,251

[1] Changes for table in Minerals Yearbook, 1948 (p. 1354) are as follows: Amorphous exported to Honduras should read $103; Dominican Republic, 3 tons; Peru and Venezuela, less than 1 ton; total, 139 tons, value $31,189. Flake, crystal, lump and chip: Brazil, $54; British Guiana, $200; Dominican Republic, $153; Guatemala, $102; India, $84, Saudi Arabia, $97, total, $10,500. Natural, n. e. s.: Chile, $127; total, $86,242.

[2] Less than 1 ton.

World Review.—Available statistics on the world production of graphite for 1943–49 are shown in the accompanying table. Comparable figures for 1915–39 were published in Minerals Yearbook, Review of 1940 (p. 1414), and for 1938–46 in Minerals Yearbook, 1946 (p. 1287).

World production of natural graphite, by countries,[1] 1943–49, in metric tons

[Compiled by Helen L. Hunt]

Country [1]	1943	1944	1945	1946	1947	1948	1949
Argentina	237	455	333	250	(2)	(2)	(2)
Australia:							
New South Wales	114	142	51	117	100	77	(2)
Queensland	360	52	58	234	187	147	[3] 13
South Australia	88	253	5	2	21	10	[4] 34
Tasmania	7						[3] 5
Western Australia	11						(2)
Austria	[5] 25,336	22,487	3,483	252	3,845	11,300	14,093
Brazil (exports)	19	199	131	92	129	83	(2)
Canada	1,726	1,435	1,733	1,792	2,175	2,303	1,905
Ceylon (exports)	20,373	12,461	7,946	8,212	9,150	14,221	12,437
China	[6] 10,000	[6] 10,000	[6] 10,000				(2)
Czechoslovakia	21,252	21,459	10,973	5,108	7,000	15,000	(2)
Egypt		260	152			50	(2)
French Indochina	25	30					
French Morocco	265	213	262	640	400	284	72
Germany: Bavaria	34,960	36,357	(2)	3,800	4,930	5,757	5,097
India	1,152	942	1,316	1,653	1,255	1,675	(2)
Italy	6,309	3,008	2,276	2,593	3,845	6,743	4,011
Japan [7]	[8] 3,859	[8] 4,859	[8] 2,609	7,417	[9] 8,000	9,137	5,299
Kenya	(10)	10	3				
Korea	96,471	103,306	32,407	6,204	[9] 10,000	[11] 15,454	[11] 40,671
Madagascar	12,949	14,478	9,185	6,315	5,170	[12] 8,438	[12] 9,767
Malaya	[9] 163	[9] 163	[9] 163			(2)	(2)
Mexico	20,677	12,977	23,634	21,949	27,984	35,261	23,812
Mozambique	428			200	126	120	(2)
Norway	3,178	3,784	1,115	661	2,481	1,125	(2)
Southern Rhodesia		5	6				
South-West Africa	1,758	1,633	1,318	1,193	1,639	1,627	2,264
Spain	57	91	128	320	309	241	(2)
Spanish Morocco	79	42	100	[9] 120	[9] 150	25	
Sweden	171		802				(2)
Union of South Africa	442	324	196	278	221	172	[3] 83
United States (amorphous and crystalline)	9,016	4,906	4,434	5,058	3,980	9,026	5,536
Total (estimate)[1]	272,000	256,000	145,000	75,000	94,000	139,000	150,000

[1] In addition to countries listed, graphite has been produced in Bulgaria, Greenland, Nyasaland, and U. S. S. R., but production data are not available. No estimates for these countries are included in totals.
[2] Data not available; estimates by author of chapter included in total.
[3] January to September, inclusive.
[4] January to June, inclusive.
[5] Includes scrap.
[6] Estimated Japanese imports from Manchuria.
[7] Data revised in some instances to represent refined graphite rather than crude or mined.
[8] Fiscal year ended March 31 of year following that stated.
[9] Estimate.
[10] Less than 1 ton.
[11] South Korea only.
[12] Exports.

In normal times Madagascar can produce over 12,000 metric tons of graphite per year. A cyclone on March 7, 1949, struck graphite-producing areas and delayed production at many of the mines on the island.[3] This storm and a shortage of jute bags delayed somewhat the normal output in the first half of 1949 but production in the latter half was reported to be back at the standard rate.

An announcement has been made of an agreement between the United States and France whereby Madagascar will sell 19,800 metric tons of graphite to the United States. This agreement, stipulating that the material will be delivered at the rate of 3,000 tons annually, was authorized after taking into account French domestic needs and foreign trade requirements.[4]

[3] Bureau of Mines, Mineral Trade Notes: Vol. 28, No. 5, May 1949, pp. 31–32.
[4] Chemical and Engineering News, vol. 27, No. 6, Feb. 7, 1949, pp. 349–350. Mining World, vol. 11, No. 9, August 1949, p. 53. Engineering and Mining Journal, vol. 150, No. 3, March 1949, p. 86.

As announced in the "Journal Officiel de Madagascar et Dependencies" for January 7, 1950, the minimum f. o. b. export price, in CFA francs, for Madagascar graphite was raised as of January 1, 1950. However, the new order, made because of the recent franc devaluation, does not change the minimum f. o. b. price in U. S. dollars established October 1, 1948.[5] The prices are shown in the accompanying table.

Minimum export price of graphite, f. o. b. Madagascar, in 1949

Flake		Powder (fines)	
Carbon, percent	Price per metric ton	Carbon, percent	Price per metric ton
85.0–87.5	$150	72.5–77.5	$82
87.6–89.5	156	77.6–82.5	96
89.6–92.5	164	82.6–87.5	116
92.6–94.9	185	87.6–89.9	143
95.0 and over	Not fixed	90.0 and over	Not fixed

Developments in the graphite field throughout the world hold some promise of future ample supplies. In Ceylon, the Bogola Graphite Corp., and the Pilot Industrial Trust, Ltd., of London, have organized to increase graphite production from 500 tons a month to 2,000 tons and to establish secondary industries.[6]

Recent reports state that preliminary surveys, to include graphite, are planned for Tanganyika[7] and that prospecting is being conducted at a graphite deposit inland from Trujillo, Peru.[8] Other reports state that conditions are good for the development of large graphite deposits in the State of Espirito Santo, Brazil.[9]

GREENSAND

In all, 5,172 short tons of greensand were produced during 1949 by the following companies: The Permutit Co., 330 West Forty-second Street, New York 18, N. Y.; Zeolite Chemical Co., Medford, N. J.; and the Inversand Co., 226 Atlantic Avenue, Clayton, N. J. All production was from open-pit operations in Burlington and Gloucester Counties, N. J., and was sold for water softening and purification.

Price of refined greensand, f. o. b. shipping point, ranged from approximately $62–$114 per short ton.

Greensand marl sold or used by producers in the United States, 1945–49

Year	Short tons	Value	Year	Short tons	Value
1945	4,986	$477,919	1948	7,269	$392,959
1946	5,140	424,900	1949	6,128	276,564
1947	8,337	432,980			

[5] Bureau of Mines, Mineral Trade Notes: Vol. 30, No. 2, February 1950, p. 41.
[6] Mining World, vol. 11, No. 8, July 1949, p. 31. Mining Journal, vol. 232, No. 5926, Mar. 19, 1949, p. 210.
[7] Mining Journal, vol. 233, No. 5959, Nov. 5, 1949, p. 1049.
[8] Engineering and Mining Journal, vol. 150, No. 9, September 1949, p. 144.
[9] Mining World, vol. 11, No. 2, February 1949, p. 59.

KYANITE, ANDALUSITE, SILLIMANITE, AND DUMORTIERITE

The domestic production of kyanite in 1949 declined from the record output of the preceding year. Imports from British East Africa and India, the principal foreign sources, decreased considerably from the 1948 totals. The consumption of imported kyanite likewise declined.

Production.—Output of domestic kyanite in 1949 totaled 12,115 short tons ($403,169) compared with 14,552 tons ($527,042) in 1948.

Three companies reported production of kyanite in 1949. A. P. Green Firebrick Co., Mexico, Mo., produced from its operation in Habersham County, Ga., and used it in the manufacture of refractories. The company subsequently closed the mine.[10] Kyanite Mining Corp., Cullen, Va., produced kyanite near Farmville, Prince Edward County, Va., and sold the output for the manufacture of refractories, pottery, and brick. Commercialores, Inc., 39 Cortlandt Street, New York, N. Y., produced kyanite from a deposit near Clover, S. C.[11] The material is sold for the manufacture of high-temperature fire brick, cement, etc.

The Technical Porcelain & Chinaware Co., El Cerrito, Calif., produced a small amount of andalusite from its Mineral County, Nev., mine and used this material in the manufacture of chinaware. A small quantity of dumortierite was produced by R. A. Stranahan, Jr., 900 Upton Avenue, Toledo, Ohio, from his Pershing County, Nev., open-pit operation; it was used in the production of spark-plug insulators.

Search for sillimanite deposits of commercial importance continues to show promise in certain areas of the United States. Geologists are continuing investigations of mica and sillimanite deposits in the Piedmont section.[12]

Reports on deposits of sillimanite minerals in Madison County, Mont.,[13] and on the occurrence of sillimanite in New Castle County, Del., have been released.[14] Other papers dealing with uses of sillimanite appeared in the press during 1949.[15]

Consumption and Stocks.—Consumption of imported kyanite was 9,655 short tons in 1949 compared with 11,770 tons in 1948 and 13,807 tons in 1947.

Year-end stocks of imported kyanite were 4,664 tons in 1949 compared with 5,538 tons in 1948 and 1,436 tons in 1947. These figures exclude material in the National Stockpile.

Prices.—Trade-journal quotations for domestic kyanite in December 1949, per ton f. o. b. point of shipment Virginia, were: 35-mesh, carlots, in bulk $26; in bags, $29; for 200-mesh, in bags, carlots, $37. Imported kyanite, in bags, c. i. f. Atlantic ports, $30–$40 per ton, nominal.

Foreign Trade.—Data on imports and exports of kyanite and allied minerals are shown in the accompanying table.

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[10] Engineering and Mining Journal, vol. 150, No. 10, October 1949, p. 123.
[11] Pit and Quarry, Kyanite Exploitation: Vol. 42, No. 1, July 1949, pp. 80–82, 160.
[12] Mining Congress Journal, vol. 35, No. 8, August 1949, p. 56.
[13] Economic Geology, vol. 44, No. 3, May 1949, p. 245.
[14] Rocks and Minerals, vol. 24, Nos. 7–8, July–August, 1949, p. 358.
[15] Ceramic Industry, vol. 52, No. 1, January 1949, p. 141. Brick and Clay Record, vol. 114, No. 5, May 1949, p. 36. Journal, American Ceramic Society, vol. 32, No. 5, May 1, 1949, p. 136.

Kyanite imported for consumption and kyanite and allied minerals exported from the United States, 1945–49

[U. S. Department of Commerce]

Imports			Exports		
Year and origin	Short tons	Value	Year and destination	Short tons	Value
1945	15,074	$182,140	1945	307	$20,205
1946	11,374	130,341	1946	342	17,881
1947	12,182	150,674	1947	239	20,533
1948			1948		
Australia	1,619	23,861	Canada	330	15,001
British East Africa [1]	8,446	110,552	Mexico	111	4,577
India	6,823	122,544	Netherlands	20	2,100
Mozambique	203	2,098	Nicaragua	1	135
Total	17,091	259,055	Total	462	21,813
1949			1949		
Australia	7	69	Canada	588	21,472
British East Africa [1]	6,342	146,520	Italy	242	16,500
India	5,434	163,653	Mexico	169	5,837
Mozambique	336	14,614	Netherlands	20	2,100
			Switzerland	20	816
Total	12,119	324,856	Total	1,039	46,725

[1] Includes the following quantities credited by the U. S. Department of Commerce to Union of South Africa: 1948—338 tons, $4,876; and 1949—11 tons, $242.

Kenya and India.—As reported in the 1948 chapter, attention has been centered on procuring kyanite of suitable quality for stockpiling from Kenya Colony, British East Africa. The uncertainty of production and transportation facilities in India has made it necessary to arrange for other sources of supply. To this end the Economic Cooperation Administration announced approval of a plan to assist in the expansion of kyanite production in Kenya. Money will be provided for purchasing mining machinery to foster this increased output. The plans call for the production of Kenya Kyanite, Ltd., to be raised from 25,000 to 37,000 short tons a year. The increased output is to be sold to the United States for the National Stockpile.[16]

The Geological Survey of India, Calcutta, names the following important occurrences of Kyanite in India: Himalaya—abundant in schists and granites of Bashahr; Hyderabad—Charribpet in the garnet mines, Warangal Taluk; Madras—Coimbatore district, near Kanjikovil, Nellore district, one half mile west of Marasimha Kandrika, 3 miles west northwest of Podalkur; Punjab—Patiala, in the hills west of Narnaul; Bihar—Manbhum, Singhbhum (Lapsa Baru), Dhalbhum, Rakha Mines; Badia—Mushabani, Kanyaluka, and Shirbai; Mysore—Mavinkere Taluk.[17]

LITHIUM MINERALS

A growing interest in lithium minerals and compounds resulted in increased production of lithium minerals during 1949. The lithia content of the ores shipped was exceeded only in the war year

[16] Mining Journal, vol. 232, No. 5934, May 14, 1949, p. 359. Mining and Industrial Magazine, vol. 39, No. 7, July 1949, p. 387. Mining World, vol. 11, No. 9, August 1949, p. 53. Mining Journal. vol. 233, No. 5951, Sept. 10, 1949, p. 830.

[17] Bureau of Mines, Mineral Trade Notes: Vol. 29, No. 4, October 1949, p. 32.

1944. In the last decade, lithium minerals and compounds have risen from little-known and little-used substances to important industrial, chemical, and metallurgical materials. In ceramic and petroleum products, metallurgy, organic synthesis, storage batteries, air conditioning, and welding, lithium compounds find important applications; they are the subject of an increasing number of patents, and many possible new uses are being suggested. During World War II, the hydride was used in large quantities as a carrier of hydrogen for inflating naval balloons.

Production.—In 1949 the following firms reported production of lithium ores and compounds: American Potash & Chemical Corp., 3030 West Sixth Street, Los Angeles 54, Calif., on Searles Lake (crude sodium lithium phosphate); Black Hills Keystone Corp., Keystone, S. Dak. (amblygonite and spodumene); Lithium Corp. of America, Inc., 2560 Rand Tower, Minneapolis, Minn., plant at Keystone, S. Dak. (spodumene); Robert McRobbie, Custer, S. Dak. (spodumene); Maywood Chemical Works, Maywood, N. J., mine at Keystone, S. Dak. (spodumene); and Whitehall Co., Keene, N. H., mine at Newry, Maine (spodumene).

Shipments of lithium ores and compounds from mines in the United States, 1935–39 (average) and 1945–49

Year	Ore (short tons)	Value	Li_2O (short tons)	Year	Ore (short tons)	Value	Li_2O (short tons)
1935–39 (average)	1,327	$48,280	88	1947	2,441	$151,113	199
1945	2,446	285,520	274	1948 [1]	3,881	210,792	291
1946	3,065	303,892	323	1949	4,838	345,970	475

[1] Revised figures.

Uses.—An article described results of experiments in the use of lepidolite in semivitreous and vitreous bodies of low maturing temperatures.[18] The effect of lithia on the properties of a titania cover enamel were reported.[19] An article described the use of lithium compounds in vitreous enamel.[20]

Late in 1949 considerable publicity was given to the news that the United States was considering an attempt to develop a "lithium-hydrogen bomb," which, in theory, would have fantastic explosive power, many times that of the first atomic bombs.

The use of lithium chloride as a substitute for salt in "salt-free diets" was condemned as a dangerous practice by the Food and Drug Administration after reports of injury to persons using such material.

A booklet was published summarizing the properties and uses of lithium and lithium chemicals as presented in the literature since 1940.[21]

[18] Donahey, J. W., and Clark, J. D., Lepidolite, a Neglected Cost-Cutting Flux: Ceram. Ind., vol. 53, No. 5, November 1949, pp. 74–76 and 94.
[19] Cook, Ralph L., and Essenpreis, James F., Effect of Soda, Potash, and Lithia on Physical Properties of a Titania Cover Enamel: Jour. Am. Ceram. Soc., vol. 32, No. 3, 1949, pp. 114–120.
[20] Fenton, W. M., and Huppert, P. A., Influence of Certain Compounds of Lithium in Vitreous Enamel: Sheet Metal Ind., vol. 25, No. 259, 1948, pp. 2255–2259.
[21] Foote Mineral Co., Lithium in Modern Industry: Philadelphia, January 1950, 25 pp.

Research quantities of lithium deuteride and lithium aluminum deuteride were made available by Metal Hydrides, Inc., Beverly, Mass., on orders bearing license from the Atomic Energy Commission.[22]

Prices.—Trade journal quotations of prices for lithium ores were as follows: Amblygonite, per ton, air-floated, carlots, $110; lepidolite, per ton, 4 percent Li_2O, powdered, carlots, $80; spodumene, per unit lithium oxide contained, $6–$8 on 6-percent grade, carlots. These prices represent no appreciable change from 1948.

The American Potash & Chemical Corp., Trona, Calif., reported the price of dilithium sodium phosphate at about $170 per ton.

Canada.—Northern Chemicals, Ltd., proceeded with the development of the spodumene deposit at Cat Lake, about 90 miles northwest of Winnipeg, Manitoba.[23]

MEERSCHAUM

Meerschaum is a soft, fine-grained, earthy, white, gray, or yellow material having the composition of $H_4Mg_2Si_3O_{10}$. The few scattered deposits known in the United States have yielded only a small production. The meerschaum deposits in Asia Minor have produced virtually the world's supply, which has been used in the manufacture of pipes and other smokers' articles. As indicated in the following table, imports from Turkey in 1949 increased to the 1947 level.

Meerschaum imported for consumption in the United States, 1945–49 [1]

[U. S. Department of Commerce]

Year	Pounds	Value	Year	Pounds	Value
1945	33,292	$59,418	1948	3,000	$10,079
1946	14,469	21,785	1949	5,844	13,897
1947	5,758	10,534			

[1] All from Turkey.

MINERAL-EARTH PIGMENTS

The economics and recent trends of the mineral pigments industry were outlined in a paper published in 1949.[24]

Production.—Demand for mineral-earth pigments declined somewhat in 1949, and sales of most items were lower than in the previous year. The early part of the year was slow, but as building and general industrial activity improved, demand for pigments increased during the latter part of 1949. Of the 89,628 tons of pigment reported, the natural red oxides constituted 20 percent, pure red oxide 18 percent, "other red oxides" 18 percent, and pure yellows 10 percent.

[22] Chemical and En[illegible]eering News, vol. 27, No. 3, Jan. 17, 1949, p. 182.
[23] Northern Miner ([illegible]ronto), vol. 35, No. 25, Sept. 15, 1949, p. 7.
[24] Myers, W. M., E[illegible]nomics of Mineral Pigments; Am. Inst. Min. and Met. Eng. Min. Trans., vol. 184, pp. 458–60.

Natural mineral pigments and manufactured iron-oxide pigments sold by processors in the United States, 1948–49, by kinds

Pigment	1948		1949	
	Short tons	Value	Short tons	Value
Mineral blacks	14,383	$225,129	2,009	$50,519
Precipitated magnetic blacks	1,585	347,591	1,415	320,858
Natural brown oxides (metallic browns)	5,862	312,163	4,962	259,413
Vandyke brown (finished pigment)	188	31,729	106	18,199
Pure browns (96 percent or better iron oxides)	910	222,712	958	243,943
Natural red oxides	20,902	874,110	18,082	807,800
Pure red oxides (98 percent or better Fe_2O_3)	17,345	3,939,317	15,918	3,661,241
Venetian reds	5,361	482,651	4,598	418,043
Pyrite cinder	1,697	121,560	1,637	121,650
Other red iron oxides	15,104	1,751,185	16,091	1,867,795
Natural yellow oxides (high Fe_2O_3)	(1)	(1)	5,149	113,154
Pure yellows (85 percent or better Fe_2O_3)	9,734	1,648,529	8,898	1,611,076
Ochers (low Fe_2O_3)	6,769	164,902	3,989	125,091
Siennas:				
Burnt	973	132,845	751	117,722
Not burnt	1,072	135,714	1,160	164,765
Umbers:				
Burnt	3,085	330,224	2,481	294,610
Not burnt	711	61,846	629	64,951
Other	5,636	175,215	795	92,084
Total	111,317	10,957,422	89,628	10,352,914

[1] Included with "Other."

Uses.—The optical properties, hiding power, and surface chemistry of pigments and a discussion of new pigments and some important improvements in old ones during the past 25 years were the subjects of a paper.[25]

Prices.—According to the Oil, Paint and Drug Reporter, prices were quoted as follows during December 1949 (in cents per pound, bags, works, carlots, unless otherwise noted):

Synthetic iron brown (l. c. l.), 12½.
Metallic oxide brown, 3–3½.
Sap brown, crystals, 12.
Sap brown, powdered, 13.
Sienna, burnt, 3¾–14¾.
Sienna, raw, 4–12¾.
Umber, burnt, American (barrels), 4¾–5¾.
Umber, Turkey type, 5¾–7¾.
Vandyke (barrels), 9¾–12.
Synthetic red iron oxide, 11½–11¾.
Special, high color, synthetic red iron oxide, $1.
Persian Gulf oxide, 6¾–7.
Spanish oxide, Grade 1 (barrels), ex dock, 5½–5¾.
Spanish oxide, Grade 2 (barrels), ex dock, 5¼–5½.
Venetian reds, 3.5–4.9.
Natural yellow iron oxide, 1.41–2.5.
Natural yellow iron oxide, French type, 4¼.
Synthetic yellow iron oxide, 9.
Golden American yellow ocher 1½–2¾.
Metallic red (barrels), 2½–2¾.
Synthetic iron oxide black, 10¾.
Mineral black, 1.6–6.75.

Foreign Trade.—Imports and exports of mineral pigments are shown in the accompanying tables.

[25] Barnett, C. E., Physics and Chemistry of Pigments: Ind. and Eng. Chem., vol. 41, No. 2, February 1949, pp. 272–79.

Selected mineral pigments imported for consumption in the United States, 1946–49

[U. S. Department of Commerce]

Pigments	1946		1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Iron oxide pigments:								
Natural	5,423	$318,239	3,755	$250,137	1,967	$138,169	1,194	$94,343
Synthetic	759	106,302	595	94,937	705	112,363	767	120,281
Ocher, crude and refined	167	6,528	258	14,362	89	4,975	89	5,058
Siennas, crude and refined	755	73,129	725	65,787	251	22,064	211	16,567
Umber, crude and refined	3,134	95,815	2,206	59,524	1,695	45,130	1,758	47,730
Vandyke brown	101	10,432	253	23,955	222	20,198	118	11,757
Total	10,339	610,445	7,792	508,702	4,929	342,899	4,137	295,736

Dry ocher, sienna, umber, and other forms of iron oxide for paint exported from the United States, 1946–49, by countries

[U. S. Department of Commerce]

Country	1946		1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Argentina	55	$11,340	98	$21,522	9	$1,904	9	$2,549
Belgian Congo	22	2,402			7	773		
Belgium-Luxembourg	201	30,886	759	148,725	631	123,070	201	39,467
Bolivia	15	2,618	6	1,358	1	560	21	7,555
Brazil	304	58,265	396	94,122	103	25,665	155	43,575
Canada	3,279	327,323	3,234	337,037	2,974	259,540	3,076	248,780
Chile	28	4,980	95	22,563	110	25,664	80	14,801
China	147	25,219	158	34,873	87	27,044	21	5,081
Colombia	181	40,654	216	63,449	112	33,501	119	38,891
Cuba	410	48,649	307	53,716	269	50,643	298	41,395
France			157	27,569			24	8,132
Greece	4	1,397	1	156	135	24,539	75	18,158
Hong Kong	25	4,738	89	22,748	62	15,400	77	20,210
India	(1)	75	10	3,616	88	59,011	2	634
Italy	2	3,234	14	6,905	71	20,713	118	33,614
Mexico	136	31,660	183	44,238	123	28,417	124	30,191
Netherlands	198	13,353	487	44,953	824	96,546	452	44,026
Netherlands Antilles	6	1,398	11	2,683	14	3,754	17	5,097
Panama	45	6,420	13	3,598	94	6,770	8	2,103
Peru	41	7,957	29	8,732	19	3,057	21	4,827
Philippines	53	6,411	89	17,839	62	11,919	132	23,169
Portugal	125	7,660	77	18,330	32	7,933	38	9,118
Sweden	103	18,468	145	26,577	11	2,887	7	2,058
Switzerland	69	9,247	47	10,618	56	12,059	34	3,733
Union of South Africa	52	25,742	50	10,244	94	25,672	121	32,746
United Kingdom	75	7,815	276	10,907	469	18,750	807	31,312
Uruguay	18	3,142	52	11,231	82	18,580		
Venezuela	187	35,704	153	30,038	159	41,370	141	41,571
Other countries	306	57,360	461	108,966	231	55,386	274	74,081
Total	6,087	794,117	7,613	1,187,313	6,929	1,001,727	6,443	826,874

[1] Less than 1 ton.

MINERAL WOOL

The value of mineral wool used in housing was $41,749,425 for 1949 compared with $45,819,000 for 1948, according to estimates by the National Mineral Wool Association. The Industrial Mineral Wool Institute estimated 1949 sales for "industrial power and process

equipment and cold-storage structures" and "domestic and commercial equipment, cargo, freight and passenger end uses" at about \$23,432,000 compared with \$21,000,000 in 1948. Details of the various kinds of mineral wool shipped in 1947 were published by the Bureau of the Census and summarized in Minerals Yearbook, 1948 (p. 1362).

New plants and improved techniques have been noteworthy in the industry in 1949. Superior Insulation Manufacturing Co., Duluth, Minn., started production of rock wool. In addition to white wool the company has introduced a dark mineral wool utilizing traprock as a part of the raw batch.[26] Rock Products Corp., Ada, Okla., is planning to construct a rock-wool plant at Ada, and to use dolomite quarried at Troy, Okla.[27]

Articles covering the manufacture of mineral wool and increasing the efficiency of operation appeared in the press during 1949. These reports discuss cupola heat balance and fuel ratio, estimating cupola output, use of cupola gases under boilers, and cupola operation, furnace types, etc.[28]

Automatic packaging for mineral wool has received attention,[29] and a description of an acoustical tile called "fissuretone" has been released.[30] Mention has been made of new engineering standards for the use and application of mineral-wool insulation in plants and refineries. These standards, CS-105 on low-temperature installations and CS-117 on heated industrial equipment, have been prepared by the National Bureau of Standards in cooperation with the Industrial Mineral Wool Institute.[31]

Several United States patents dealing with mineral wool have been released; No. 2,451,582 covers improvements in a furnace, 2,450,916 apparatus for forming mineral-wool mats, 2,450,511 apparatus for diverting mineral wool from blow rooms, 2,450,013 apparatus for producing rock wool, and 2,450,915 forming mineral-wool products.[32]

MONAZITE

Monazite is important commercially as the principal source of the rare earths and thorium. However, statistics on imports and consumption of monazite are considered confidential and cannot be published for 1949. In former years, India and Brazil have been the most important sources; but in recent years India has imposed a virtual embargo on exports of monazite, and increasing difficulty has been encountered in obtaining it from Brazil. There were reports of considerable agitation in Brazil to restrict the exportation of monazite. Both of these countries are considering large-scale processing of monazite into rare-earth and thorium products. The Indian Government entered into an agreement with two French firms, Banque

[26] Rock Products, vol. 52, No. 2, February 1949, p. 79. Pit and Quarry, vol. 42, No. 5, November 1949, pp. 117-118.

[27] Rock Products, vol. 52, No. 12, December 1949, p. 82.

[28] Azbe, Victor J., Solution of Problems in Manufacturing Rock Wool: Rock Products, part II, vol. 52, No. 2, February 1949, pp. 119-123; part III, vol. 52, No. 3, March 1949, pp. 104-105; part IV, vol. 52, No. 4, April 1949, pp. 136, 142, 145, 165; part V, vol. 52, No. 5, May 1949, pp. 74-76. Rock Products, vol. 52, No. 12, December 1949, pp. 117-118. Tantillo, Joseph S., Production Problems in Mineral Wool: Rock Products, vol. 52, No. 1, January 1949, pp. 103, 104, 117.

..., p. 179.

[32] Journal, American Ceramic Society, vol. 32, No. 4, Apr. 1, 1949, pp. 105, 110, 111, 114.

Marocaine de Credit and the Société des Produits Chimiques des Terres Rares, to establish a plant for processing the monazite found in the State of Travancore.[33]

In 1949 an increased interest in domestic deposits of monazite was evident. This was probably the result of several factors, such as the difficulty of procuring supplies from the usual foreign sources, increasing prices, improved processes for separating the rare-earth metals in a pure form not previously attainable, and new and potential uses for the thorium and rare-earth products of monazite.

Monazite is known to occur in many locations in the United States, and several companies are considering recovery of this mineral as a byproduct. The Climax Molybdenum Co., in its 1949 Annual Report to the Stockholders, announced its intention of recovering monazite as a byproduct of its molybdenum operations at Climax, Colo. Rare Earths Development Co., an outgrowth of Rare Earths, Inc., has been formed at McCall, Idaho, to recover monazite sands.[34] Monazite has been recovered from the gold-bearing sands and gravels of the Boise Basin, and the reserves in this area are believed to be large. The University of Idaho, Moscow, Idaho, continued its program of research in the chemical separation of the rare-earths metals in monazite.[35] A report was published summarizing the preliminary investigation of these Idaho placer sands.[36]

It is reported that monazite is almost always present in the pebble phosphate deposits of Florida but always in small amounts and sometimes only in traces.[37] Monazite is also known to occur in the dune and beach sands of Florida and other points along the Atlantic coast, and in the stream gravels of the Appalachian region, where it has been produced in the past.

A discovery of considerable interest as a possible source of the rare earths was announced by the United States Geological Survey. A deposit of bastnaesite has been found in San Bernardino County, Calif. This mineral is a fluocarbonate of the rare earths with thorium and a very small percentage of uranium.[38]

The results of research on the refractory characteristics of the rare-earth sulfides conducted at the University of California, Department of Chemistry and Radiation Laboratory, were reported to the national meeting of the American Chemical Society.[39]

Cerium oxide was placed on the positive list of commodities requiring a validated license for exportation to all Group O and R destinations by the Office of International Trade on June 24.[40]

According to E&MJ Metal and Mineral Markets, monazite was advanced to $245 per metric ton, 65 percent rare-earth oxides including thorium oxide and cerium oxide. However, lower-grade material can be sold at a penalty.

[33] Chemical Age, vol. 61, No. 1575, Sept. 17, 1949, p. 403.
[34] Pit and Quarry, vol. 41, No. 10, April 1949, p. 63.
[35] Mining Congress Journal, vol. 35, No. 9, September 1949, p. 82.
[36] Staley, W. W., and Browning, James S., Preliminary Investigation of Concentrating Certain Minerals in Idaho Placer Sands: Idaho Bureau of Mines and Geology, Pamph. 87, June 1949, 23 pp
[37] Hunter, Frank R., Occurrence of Heavy Minerals in the Pebble Phosphate Deposits of Florida; Mining Technol., vol. 12, No. 5, Sept. 1948; Am. Inst. Min. and Met. Eng. Tech. Paper 2456, 3 pp.
[38] U. S. Department of the Interior, Information Service, Geol. Survey, press release, Nov. 18, 1949.
[39] Chemical Industries, vol. 64, No. 5, May 1949, p. 741.
[40] Oil, Paint and Drug Reporter, vol 156, No. 1, July 4, 1949, p. 3.

OLIVINE

Shipments of olivine in 1949 declined to 3,528 short tons valued at $56,850 from the 4,766 tons valued at $86,230 in the preceding year.

Considerable interest has been aroused regarding the use of olivine in foundries as a refractory and as a substitute for silica sand. It has been reported that this material does not cause silicosis and can be used in places where dust is created.[41] A recent report states that of the olivine group, forsterite has the most applications in industry. The high melting point and low thermal conductivity make it a satisfactory constituent of refractory materials.[42] Olivine is being produced in Norway and substantial amounts of this material are being exported to England and the United States. Government-owned mines are located in the county of Sunnmore, and the processing plant is at Vanylven, about 30 miles southwest of Aalesund.[43] Recent reports indicate that olivine of suitable quality for industrial purposes has been found in the Haute-Vienne Department of France.[44]

Olivine sold or used by producers in the United States, 1945–49

Year	Short tons	Value	Year	Short tons	Value
1945	(1)	(1)	1948	4,766	$86,230
1946	7,649	$92,868	1949	3,528	56,850
1947	10,838	129,094			

[1] Data not available for publication.

Descriptions of the preparation of phosphate fertilizer, utilizing phosphate rock and olivine, have been discussed in the literature. It is reported that the mixture of two parts of phosphate rock to one part of olivine is fused in an electric furnace at 1,500° to 1,600° C., and that 1 ton of the mixed material yields 0.9 to 0.95 ton of phosphate fertilizer.[45]

Permanente Metals Co., at Permanente, Calif., has been producing a fused calcium-magnesium phosphate fertilizer from serpentine and Idaho phosphate rock. Late in 1949 the name of the company was changed to the Kaiser Aluminum & Chemical Corp.[46]

A report covering thermodynamic data in the series Mg_2SiO_4–Fe_2SiO_4 and $MgSiO_3$–$FeSiO_3$ has been released. Information on analyses and heat-of-solution measurements are included in the paper.[47]

PERLITE

The perlite industry shows signs of growth as production of crude perlite in 1949 reached a record of 59,239 short tons—an increase

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[41] Journal, American Ceramic Society, vol. 32, No. 6, June 1, 1949, p. 150.

[42] Mine & Quarry Engineering, vol. 15, No. 1, January 1949, p. 2.
Refractories Journal, Olivine: Its Use for Refractories and Moulding Sands: No. 8, August 1949, p. 275.

[43] Ceramic Age, vol. 54, No. 3, September 1949, pp. 166–167.
Refractories Journal, No. 12, December 1949, p. 451.

[44] Chemical Age, vol. 60, No. 1538, Jan. 1, 1949, p. 27.

[45] Engineering and Mining Journal, Electric Furnace Used on Phosphate and Olivine: Vol. 150, No. 5, May 1949, p. 98.
Moulton, R. W., Electric Furnace Fertilizer; Ca-Mg Phosphate: Chem. Eng., vol. 56, No. 7, July 1949, pp. 102–104.

[46] Crossman, R., Permanente Produces New Phosphatic Fertilizer: Commercial Fertilizer, vol. 79, No. 3, September 1949, pp. 41–42.

[47] Sahama, Th. G., and Torgeson, D. R., Thermochemical Study of the Olivines and Orthopyroxenes: Bureau of Mines Rept. of Investigations 4408, 1949, 24 pp.

of 338 percent above the output in 1948. Sales of expanded perlite amounted to 40,505 short tons valued at $1,975,524.

Twenty-seven companies reported production or sales of perlite in 1949, the majority of which were located in the western part of the United States near the source of crude material. California had seven companies in operation, Nevada six, Utah four, Arizona two, New Mexico two, and Colorado, Illinois, Minnesota, Ohio, Oregon, and Pennsylvania one each. In addition to the above, the following companies reported experimental or developmental output: F. E. Schundler Co., Joliet, Ill.; Midwest Perlite Co., 912 West College Avenue, Appleton, Wis.; Masco Perlite, Inc., 500 Fauna Street, Houston, Tex.; and United States Perlite Co., 609 South Grand Avenue, Los Angeles, Calif.

Production and sales of perlite in the United States, 1946–49

Year	Production, crude (short tons)	Sold or used by producers			
		Crude		Expanded	
		Short tons	Value	Short tons	Value
1946	4,206	(1)	(1)	(1)	(1)
1947	10,810	6,264	$21,959	(1)	(1)
1948	13,530	(1)	(1)	9,327	$182,277
1949	59,239	41,983	266,055	40,505	1,975,524

1 Bureau of Mines not at liberty to publish figure.

Other items of interest to the industry concern the plans of Great Lakes Carbon Co., New York, to move its crushing and classifier plant from Superior, Ariz., to a location near Socorro, N. Mex.,[48] and plans of the same company to operate a perlite processing plant at Linden, N. J. The daily output is estimated to be 75 tons of lightweight plaster and concrete aggregate.[49] The Western Perlite Corp., Phoenix, Ariz., has purchased the processing facilities of the Perlite Corp., also of Phoenix.[50] A recent report states that a perlite expansion plant is being built at Lordsburg, N. Mex.,[51] and that several companies in the western part of the United States are considering the advisability of establishing expanding plants in the east and furnishing these plants with prepared crude perlite.[52]

The Trilite Corp., Houston, Tex., has installed facilities for the expansion of PerAlex.[53]

In an effort to promote the welfare of the growing perlite industry, a national trade organization was formed during the year. Eighteen companies producing ore or expanded perlite form the membership of the Perlite Institute, with headquarters at 35 West Fifty-third Street, New York 19, N. Y.[54]

Data on modulus of elasticity of perlite concrete and on compressive strength of concrete, using sized and unsized perlite aggregate, have

48 Engineering and Mining Journal, vol. 150, No. 3, March 1949, p. 120.
49 Pit and Quarry, vol. 41, No. 12, June 1949, p. 56.
50 Mining World, vol. 11, No. 13, December 1949, p. 78.
51 Mining World, vol. 11, No. 11, October 1949, p. 72.
52 Rock Products, vol. 52, No. 6, June 1949, p. 122.
53 Pit and Quarry, vol. 42, No. 2, August 1949, p. 55.
54 Concrete, vol. 57, No. 8, August 1949, p. 6. Pit and Quarry, vol. 42, No. 2, August 1949, p. 56.

appeared in the literature [55] as has information on the 3-hour fire tests of steel columns protected with plaster using perlite aggregate. The plaster consisted of 3 cubic feet of perlite aggregate mixed with 100 pounds of fibered gypsum.[56]

United States patent 2,455,666, granted December 7, 1948, covers the design for a horizontal, nonrotating perlite expanding furnace.[57]

Among the many uses for expanded perlite are: Plaster, concrete, pipe covering, loose-fill insulation, furnace insulation, stucco, as a filtering agent, and in the fabrication of blocks, slabs, and roof decks. In 1949, as in 1948, the principal use for perlite was for aggregates in plaster and concrete. The use of perlite as a drilling mud-additive material has been reported.[58]

RADIO-GRADE QUARTZ

Although small quantities of quartz crystal suitable for frequency-control use have been found in the United States, supplies from domestic sources are quite inadequate to supply the market. In 1949, as in the past, the bulk of the supply came from Brazil. Much smaller quantities were imported from Norway, France, India, China, and Hong Kong. Consumption of radio-grade quartz during the year continued to decline. Much of the imported material reported in the accompanying table is of optical and fusing grade and not of radio grade. The excess of imports over consumption is attributable to material rejected after inspection by consumers, stocks, and purchases for the National Stockpile.

Imports of uncut quartz crystal, consumption of radio-grade quartz, and production of piezoelectric units in the United States, 1945–49

Year	Imports of uncut quartz crystal [1]		Consumption of radio-grade quartz (pounds)	Production of piezoelectric units [2] (number)
	Pounds	Value		
1945	1,329,798	$6,190,621	1,040,000	18,918,000
1946	370,556	2,376,598	172,400	1,744,100
1947	473,788	1,815,468	68,100	1,052,400
1948	[3] 1,238,820	[3] 4,209,531	61,600	1,225,400
1949	319,798	1,462,018	46,200	937,100

[1] Includes optical-grade quartz used in production of optical instruments.
[2] Includes oscillators, resonators, and other piezoelectric units.
[3] Revised figure.

During World War II dangerous interruptions to the delivery of Brazilian quartz crystal for use in military communication equipment and later serious concern over possible lack of reserves of natural quartz caused a flurry of interest in substitutes. Soon afterward an active and coordinated program of investigation of possible substitutes for quartz and the synthesis of quartz, under the guidance of the Signal Corps, was under way. Since that time, significant progress has been made. The synthesis of quartz crystal has been technically

[55] Rock Products, vol. 52, No. 2, February 1949, p. 161.
[56] Pit and Quarry, vol. 42, No. 4, October 1949, p. 128.
[57] Journal, American Ceramic Society, vol. 32, No. 6, June 1, 1949, p. 149.
[58] Barberii, E. E., Perlite Used as Mud-Additive Material Proves Highly Effective in Tests Combating Lost Circulation: Oil and Gas Jour., vol. 48, July 28, 1949, pp. 280–284.

successful. Good crystals of around 50 grams weight have been grown; 2 pounds of growth have been added to seed material in a small autoclave in less than a month. Continuing investigations involve variations of the temperature and pressure conditions of growth, size and type of autoclave, improvement of equipment and methods for preparing and utilizing the crystal, and basic research in crystal chemistry and physics. The commercial feasibility also is being investigated.

The Signal Corps Laboratories, Fort Monmouth, N. J., developed a method of increasing the frequency-control life of a quartz crystal and preventing "drift" as crystals age. The process involves superheating the crystal and slowly cooling it.[59] Progress made in the synthesis of piezoelectric minerals for frequency control was summarized.[60]

There were reports of the discovery of a deposit of quartz crystal, described as one of the largest in Europe, at Salangsdalen in Bardu, northern Norway. Mapping was begun and Norwegian Mining, Ltd., planned to start operations late in the year.[61]

STRONTIUM MINERALS

No domestic production of strontium minerals was reported during 1949. The Western States have extensive deposits of celestite and strontianite which have been mined during wartime. These deposits occur principally in Arizona, Washington,[62] Texas, and California. The deposit near Ludlow, San Bernardino County, Calif., owned by Rowe, Mullinix & Buehler, was held in stand-by condition in expectation of producing in 1950. Normally, however, celestite is imported from Great Britain, Mexico, and Spain.

The principal peacetime uses for strontium minerals are as fillers and in the manufacture of strontium compounds for use in medicinals, ceramics, lubricants, and pyrotechnics such as signal flares. The chief military use of strontium compounds is in flares and tracer bullets.

Celestite imported for consumption in the United States, by countries, 1947–49, in short tons

[U. S. Department of Commerce]

Country	1947		1948		1949	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada					59	$788
Mexico	3,937	$57,347	1,114	$14,953	1,158	14,690
Spain	5,836	110,884	14,614	440,318	3,263	74,829
United Kingdom	4,344	74,383	6,043	103,428	4,904	86,378
Total	14,117	242,584	21,771	558,709	9,384	176,685

[59] Science News Letter, vol. 56, July 23, 1949, p. 54.

[60] Waesche, Hugh H., Synthesis of Piezoelectric Minerals for Frequency Control: Paper read before the Geological Society of America (unpublished in 1949).

[61] Chemical Engineering and Mining Review, vol. 41, No. 5, Feb. 10, 1949, p. 196.

[62] Caldwell, Wm. E., and Waterman, G. H., A Northwest Strontium Mineral Deposit: Paper read before Am. Inst. Min. and Met. Eng. meeting at San Francisco, February 1949 (unpublished in 1949).

Low-grade celestite from Texas has been used as a well-drilling mud admix. Strontium metal is discussed in the Minor Metals chapter of this volume.

Trade-journal quotations of prices for celestite, in carlots, 92 percent $SrSO_4$, finely powdered, remained unchanged at $54; crude, 90-percent grade, f. o. b. cars California, remained at $19. Strontianite, per ton lump, in carlots, minimum 84–86 percent $SrCO_3$, remained at $55, nominal.

TOPAZ

The Brewer mine near Kershaw, S. C., was inactive during 1949. A small quantity of float material was shipped by the Carolina Mining & Exploration Corp., Naples, N. C., the only producer of this material.

VERMICULITE

Production.—Sales of cleaned and screened vermiculite reached a record output of 168,819 short tons valued at $1,686,419, representing an increase of 22 percent in quantity and value over the 1948 totals.

Production in 1949 was reported by the following companies: Zonolite Co., 135 South La Salle Street, Chicago, Ill. (mines at Libby, Mont., and Travelers Rest, S. C.); American Vermiculite Co., Spruce Pine, N. C. (mine near Burnsville, N. C.); Franklin Leasehold & Mining Co., Franklin, N. C. (mine at Franklin, N. C.); Vermiculite Supplies, Inc., Sylva, N. C. (mine near Sylva, N. C.); John C. Woody, Route 1, Greenmountain, N. C. (mine near Forbes, N. C.); Girds Creek Vermiculite Products Co., Hamilton, Mont.; Harry Quaintance, Cowdrey, Colo.; and Building Materials, Inc., 617 Majestic Building, Denver, Colo. (mine at Westcliffe, Colo.).

Screened and cleaned vermiculite sold or used by producers in the United States, 1942–49

Year	Short tons	Value	Year	Short tons	Value
1942	57,848	$319,931	1946	86,390	$867,973
1943	46,645	471,595	1947	131,385	1,338,572
1944	54,116	541,744	1948	138,635	1,387,233
1945	64,868	648,077	1949	168,819	1,686,419

Reports describing deposits of vermiculite in the United States have been released. One presents data on the Montana deposits, including the notable Libby area, and the other report describes an investigation and testing of deposits in Llano County, Tex.[63] This latter report discusses laboratory test results showing influence of temperature, moisture, and flake size on exfoliation, and beneficiation of vermiculite.

Assuming an average price of $75 per ton for exfoliated material and a 5-percent loss of weight in exfoliating, the total value of exfoliated vermiculite sold in 1949 would be about $12,028,000.

Uses.—Among the many uses for vermiculite are: Insulation,

[63] Perry, E. S., Talc, Graphite, Vermiculite and Asbestos in Montana: Bureau of Mines and Geology, Butte, Mont.: Memoir 27, 1948, 44 pp. McMillan, W. D., and Gerhardt, A. W., Investigation and Laboratory Testing of Vermiculite Deposits, Llano County, Tex.: Bureau of Mines, Rept. of Investigations 4486, 1949, 42 pp.

soundproofing, aggregate for plaster and concrete, boiler insulation, pipe covering, soil amendments, oilless bearings, foundry work, blocks, brick, wallboard, stucco, rubber goods, etc.

Pyrok, a new surfacing material, is a mixture of portland cement, lime, expanded vermiculite, and water. It is reported that this mixture, applied like plaster to wood, steel, and brick work, is water proof and fire and frost resistant and does not crack.[64] A recent article shows how to prepare vermiculite acoustical plaster and gives the amounts of materials needed for plaster : vermiculite aggregate mixes ranging from 1 : 1½ through 1 : 4.[65]

The results of fire tests on a steel column protected with vermiculite plaster have been released. Columns were covered with both 1- and 1½-inch thicknesses of plaster on metal lath and were tested to critical temperatures in 3 hours and 32 minutes and 4 hours and 42 minutes, respectively. The Underwriters' Laboratories have issued official fire ratings of 3 hours and 4 hours for 1-inch and 1½-inch thicknesses, respectively.[66] Experiments with the use of vermiculite in foundry work have been discussed in the literature,[67] and United States patent 2,942,208, covering a process of exfoliating and bleaching vermiculite, has been released.[68]

Prices.—Domestic screened and cleaned vermiculite in 1949 averaged $9.99 per short ton f. o. b. mines, while quotations for South African crude were $28 to $30 per ton, f. o. b. Atlantic ports. The exfoliated material was worth about $75 a ton in 1949.

Africa.—Interest in vermiculite in foreign countries persists. Production of this mineral in the Transvaal has slumped slightly due to poor roads, reconditioning of plants, and the shortage of bags. Vermiculite, however, is still much in demand and it is reported that all three companies operating in the Palabora district are taking steps to increase production.[69]

It is reported that specifications are being prepared for vermiculite and its products for submission to the South African Bureau of Standards. This procedure will promote standardization of quality throughout the Union and provide for continuous supplies of vermiculite of specific quality.[70]

Vermiculite has been known to exist in Southern Rhodesia for some time. The Shawa Syndicate operates a claim in the Sabi Valley and preliminary reports indicate the material to be of good quality.[71] First exports in the amount of 300 tons were expected to begin in August, from Sabi Vermiculite, Ltd.[72] Areas of important vermiculite deposits in Rhodesia are found in the Dorowa-Shawa district, 42 miles west of Odzi, and on the Victoria Falls road, about 17 miles on the Wankie side of the Gwaai River bridge. Samples sent to the Imperial Institute for testing proved to be clean and high-grade vermiculite.[73]

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[64] British Abstracts, BI, April 1949, p. 306.
[65] Brick and Clay Record, vol. 115, No. 3, September 1949, p. 27.
[66] Pit and Quarry, vol. 42, No. 1, July 1949, p. 203. Rock Products, vol. 52, No. 12, December 1949, p. 122.
[67] Mining and Industrial Magazine, vol. 39, No. 3, August 1949, p. 449.
[68] United States Patent Office, Official Gazette: Dec. 27, 1949, p. 965.
[69] South African Mining and Engineering Journal, vol. 60, No. 2956, Oct. 8, 1949, p. 155.
[70] Journal, American Ceramic Society, vol. 32, No. 3, Mar. 1, 1949, p. 90.
[71] Mining World, vol. 11, No. 3, March 1949, p. 46.
[72] Engineering and Mining Journal, vol. 150, No. 9, September 1949, p. 148.
[73] South African Mining and Engineering Journal, vol. 60, No. 2926, Mar. 12, 1949, p. 61.

India.—A consular report by Howard Donovan, Counselor of American Embassy, Delhi, India, November 9, 1949, lists the principal areas of vermiculite in the State of Mysore as follows:

Bageshpura: Chemical analysis of vermiculite shows silica 38.10 percent, alumina 17.24, ferric iron 8.24, FeO 1.32, magnesia 15.49, and water 17.12.

Channarayapatna: Vermiculite is shown in prospect pits to extend to over 20 feet. Chemical analysis shows silica 36.06 percent, alumina 20.48, ferric iron 15.91, FeO 3.12, lime 3.54, magnesia 12.95, potassa 0.12, titania 0.64, and water 7.82.

Chunchankatte: Vermiculite is bronze-yellow to dark green in color. No prospecting done yet.

Midavanda: Thin occurrences of vermiculite at contact of kaolinized gneisses.

Pavagada: The first Mysore vermiculite was noted here, but prospecting has not yet begun.

Proper development of these areas will make India self-sufficient and will permit export of vermiculite.

WOLLASTONITE

The Willsboro Mining Co., Inc., produced 500 short tons of wollastonite from the Bristol Mountain open-pit operation (formerly the Burnham property) near Willsboro, N. Y. This material was valued at $14 per ton f. o. b. the shipping point at Willsboro and was sold for use in ceramics and as a chemical raw material.

PART III. STATE REVIEWS

The Mineral Industry of Alaska

By Alfred L. Ransome

GENERAL SUMMARY

DESPITE a decline for the second consecutive year, gold continued to rank first in value among mineral commodities. Notwithstanding this decrease, the total value of mineral output in the Territory rose to $15,302,000 in 1949 compared to $13,024,000 in 1948.

Mineral production of Alaska, 1947–49

Mineral	1947		1948		1949	
	Quantity	Value [1]	Quantity	Value [1]	Quantity	Value [1]
Antimony ore .... short tons	40	$16,056	68	$29,336	74	$31,356
Coal, bituminous .... do	361,220	2,554,797	407,906	2,789,275	455,000	(2)
Copper .... do	12	5,040	16	6,944	4	1,576
Gold .... troy ounces	279,988	9,799,580	248,395	8,693,825	229,416	8,029,560
Lead .... short tons	264	76,032	329	117,782	51	18,116
Mercury .... flasks (76 pounds)	127	10,635	100	7,649	100	7,946
Platinum metals (crude) troy ounces	13,512	(2)	(2)	(2)	(2)	(2)
Silver .... do	66,150	59,866	67,341	60,947	36,056	32,633
Stone .... short tons	(2)	(2)	40,730	54,637	(2)	(2)
Tin .... do	1	2,200	5	(2)	57	(2)
Tungsten (60-percent concentrates) (shipments) .... short tons	13	(2)	....	....	....	....
Zinc .... do	25	6,050	22	5,852	2	496
Miscellaneous [3]	....	5,927,319	....	1,257,699	....	7,181,886
Total	....	18,458,000	....	13,024,000	....	15,302,000

[1] The values for antimony, copper, gold, lead, mercury, silver, and zinc in this table continue to be calculated on the basis of unit prices of the smelted metals at the smelter or principal market and are therefore higher than corresponding estimates, in the Statistical Summary chapter, of the value of the ores and concentrates.

[2] Bureau of Mines not at liberty to publish separately; value included with "Miscellaneous."

[3] Comprises value of clay (1948), pumice (1947–48), sand and gravel, and items indicated by footnote 2.

Coal ranked second to gold in value of output, but although production was even greater than the former record in 1948, a lower unit price resulted in the value being only a little above that for the previous year. Platinum mining continued to be an important factor in the mineral industry, with production of crude platinum-group metals exceeding that of 1948. The output of lead was only one-sixth of the 1948 production, and silver, copper, and zinc—each a byproduct from an operation conducted primarily for another metal—was one-half, one-fourth, and one-tenth, respectively, of the 1948 production.

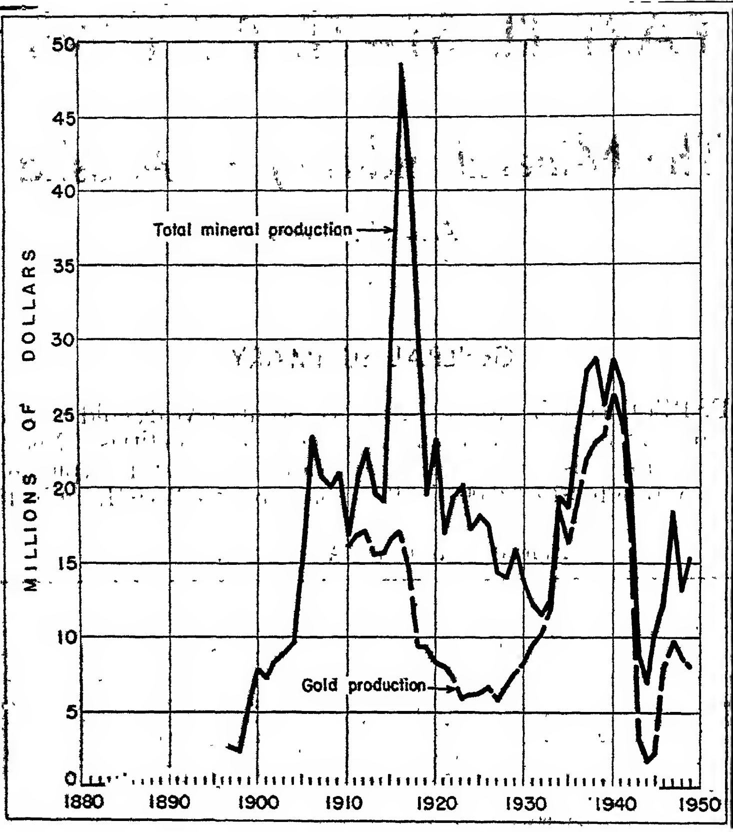

FIGURE 1.—Trends in value of total mineral production (1880–1949) and gold production (1910–49) in Alaska. From 1911 to 1931 copper production accounted for most of the value of minerals other than gold.

The output of tin was small, but substantially above that in the previous year.

Gold mining, which has maintained its position as the backbone of the mining industry in Alaska, has had ever-increasing difficulty in balancing high costs of mining, labor, and supplies against an established price for its product—the United States Treasury price of gold—which has remained unchanged since 1934. Although the supply of labor in 1949 was better than at any time since the war, the narrowing margin between high operating costs and the $35 per fine ounce official price for gold was not conducive to operation of any but the more efficient enterprises. "Natural" or unprocessed gold continued to be legally sold on the open market by a number of operators, at prices varying from $3 to $8 over the official price.

Lode mining in the Territory continued to remain virtually at a standstill; and, with the exception of coal, limestone, and sand and gravel, nonmetalliferous activity was negligible.

GOLD, SILVER, COPPER, LEAD, AND ZINC

The accompanying tables show the mine production of gold, silver, copper, lead, and zinc in Alaska, 1945–49 and 1880–1949, in terms of recoverable metals; the gold production at placer mines, by classes of mines and methods of recovery; mine production of gold, silver, copper, lead, and zinc, by regions; and ore and old tailings sold or treated and various metallurgical compilations based on output in 1949.

A small proportion of the output shown in the tables following was mined before 1949 but not shipped or sold until that year.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of gold, silver, copper, lead, and zinc production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.

[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Gold.—The recorded production of gold in Alaska in 1949 was 8 percent below the output in 1948. Only a few new operators have entered the field of gold mining, less than the number of previously established operators who either did not mine or sharply curtailed operations during 1949. One major exception was resumption of activity by the Alaska-Pacific Consolidated Mining Co. at its Independence lode-gold mine, Willow Creek district, Cook Inlet-Susitna region, for the first time since 1946. The sale of unprocessed or natural gold by a number of operators who hoped to gain by open market transactions at prices exceeding $35 per fine ounce apparently was greater in volume than in 1948. However, although some undoubtedly did benefit, others reported that the cost of handling such transactions (including assaying charges, interest on capital invested in the form of unsold gold, and transportation and insurance charges) was high enough, more or less, to offset any advantage gained by a higher price and that over-all results of natural gold sales during 1949 were disappointing. Nevertheless, 22 producers indicated that natural gold produced in 1949 had been sold for a price exceeding $35

per fine ounce. The recorded production for 1949 includes 9,836 fine ounces of gold and 88 fine ounces of silver contained in natural gold sold on the open market by 10 producers. In addition, 8,656 ounces of natural gold bullion were reported sold by 12 producers on the open market for prices equivalent to $35 or more per fine ounce of gold contained therein; information on fineness was inadequate for calculating the recoverable gold and silver content for inclusion with the 1949 statistical record. Available information indicated that an undetermined quantity of natural gold (estimated to be 5,000 ounces) was sold by 11 producers who did not report specifically, and 1,022 ounces of natural gold from 2 properties was reported produced but not sold. Specific and accurate data regarding natural gold sales are not readily available, and the afore-mentioned figures giving the number of operators and quantities involved are incomplete. However, from these data it can be assumed that approximately 22,000 ounces of natural gold bullion originating from Alaskan mines in 1949 were sold. A comparable total of 18,000 ounces was estimated sold in 1948.

Mine production of gold, silver, copper, lead, and zinc in Alaska, 1945–49, and total, 1880–1949, in terms of recoverable metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	18	143	6,512	68,117	$2,384,095	9,983	$7,099
1946	16	256	10,798	226,781	7,937,335	41,793	33,769
1947	19	200	13,891	279,988	9,799,580	66,150	59,866
1948	24	274	6,014	248,395	8,693,825	67,341	60,947
1949	18	222	78,839	229,416	8,029,560	36,056	32,633
1880–1949	----------	----------	(2)	26,841,227	652,457,547	19,959,845	14,235,037

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	5	$1,350	11	$1,892	----------	----------	$2,394,436
1946	2	648	115	25,070	----------	----------	7,996,822
1947	12	5,040	264	76,032	25	$6,050	9,946,568
1948	16	6,944	329	117,782	22	5,852	8,885,350
1949	4	1,576	51	16,116	2	496	8,080,381
1880–1949	685,698	226,577,424	25,570	2,984,563	49	12,398	896,266,969

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Figure not available.

The unusual seasonal limitations to mining activity in Alaska are indicated by the production of gold in 1949 by months, as shown in an accompanying table. The data are based on mint and smelter receipts which have been adjusted to exclude those receipts during the first 4 months which actually reflect production in 1948 and to include similar receipts during the same period in 1950 that reflect output in 1949. Nevertheless, production was probably considerably less than that shown during the last 3 months of the year, but cor-

respondingly higher for the period May through September, which represents the season for active mining in the Territory between the spring break-up or thaw and the fall freeze. The principal reason for the relatively high receipts at mints and smelters during the last quarter is that numerous operators make their gold "clean-up" only once or twice during the active mining season, the result being that a substantial quantity of gold accumulated in the sluices over a period of several months is not recovered until late fall.

The 15 leading gold-producing mines (14 placer and 1 lode) in Alaska in 1949, listed in the accompanying table, yielded 73 percent of the total recorded gold output of the Territory; the 5 leading producers supplied 57 percent. The Fairbanks district in the Yukon River Basin region, and the Nome district in the Seward Peninsula region ranked first and second, respectively, in gold production in the Territory owing to the bucket-line dredging operations of the United States Smelting, Refining & Mining Co.

Active lode-gold mining was limited to a few relatively small scale operations, with the exception of the Independence mine, Willow Creek district, Cook Inlet-Susitna region. The greatest proportion of gold recovered from lode operations came from active mines in the Willow Creek district, but a substantial quantity was from mill cleanups at mines that were inoperative during 1949.

Fifteen leading gold-producing mines in Alaska in 1949, in order of output [1]

Rank	Mine	District	Region	Rank in 1948	Operator	Source of gold
1	Fairbanks unit	Fairbanks	Yukon River Basin.	1	United States Smelting, Refining & Mining Co.	Dredge.
2	Nome unit	Nome	Seward Peninsula	3	do	Do.
3	New York Alaska Gold Dredging Corp.	Tuluksak-Aniak.	Kuskokwim	2	New York Alaska Gold Dredging Corp.	Dredge and placer.
4	Brinker-Johnson Co.	Fairbanks	Yukon River Basin.	5	Brinker Johnson Co.	Dredge.
5	Strandberg & Sons	Hughes	do	(2)	Strandberg & Sons	Placer.
6	Mohawk Association	Iditarod	do	10	North American Dredging Co.	Dredge.
7	Havenstrite Mining Co.[3]	Fairhaven	Seward Peninsula	6	Havenstrite Mining Co.	Placer.
8	C. J. Berry Dredging Co.	Circle	Yukon River Basin.	11	C. J. Berry Dredging Co.	Dredge.
9	Alluvial Golds, Inc.	do	do	12	Alluvial Golds, Inc.	Do.
10	Alder Creek Mining Co.	Fairbanks	do	7	Alder Creek Mining Co.	Placer.
11	Casa de Paga Gold Co.	Fairhaven	Seward Peninsula	9	Casa de Paga Gold Co.	Dredge.
12	Lee Bros. Dredging Co.	Nome	do	23	Lee Bros. Dredging Co.	Do.
13	Wade Creek Dredging Co.	Fairbanks	Yukon River Basin.	28	Wade Creek Dredging Co.	Placer.
14	Independence	Willow Creek	Cook Inlet-Susitna.	(4)	Alaska-Pacific Consolidated Mining Co.	Gold ore.
15	Hubbard and McFarland	Innoko	Yukon River Basin.	25	Hubbard and McFarland.	Placer.

[1] Based on known output, including natural gold sales.
[2] Production included with Cripple Creek Mining Co., Innoko district, in 1948.
[3] Produced in 1948 under name of Arctic-Circle Exploration Co.
[4] Did not produce in 1948.

Gold produced at placer mines in Alaska, 1945–49, by classes of mines and by methods of recovery

Class and method	Mines producing	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered: Fine ounces	Gold recovered: Value	Gold recovered: Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucket-line dredges:						
1945	11	14	3,112,000	34,404	$1,204,140	$0.387
1946	20	26	9,810,000	149,382	5,228,370	.533
1947	22	28	8,395,000	188,800	6,608,000	.787
1948	22	30	11,165,000	169,299	5,925,465	.531
1949	20	28	14,588,000	156,020	5,460,700	.374
Dragline dredges:						
1945	1	1	9,200	1,045	36,575	3.976
1946	1	1	65,000	2,713	94,955	1.461
1947	2	2	148,000	3,715	130,025	.879
1948–49						
Nonfloating washing plants:[1]						
1945	24	24	518,500	8,349	292,215	.564
1946	66	66	2,091,000	37,519	1,313,165	.628
1947	75	75	2,905,000	45,990	1,609,650	.554
1948	107	107	4,395,000	57,938	2,027,830	.471
1949	117	117	3,467,000	59,265	2,074,275	.598
Gravel hydraulically handled:						
Hydraulic:						
1945	80		858,000	12,903	451,605	.526
1946	116		2,123,000	30,390	1,063,650	.501
1947	114		2,371,000	36,769	1,286,915	.543
1948	82		1,220,000	14,493	507,255	.416
1949	33		252,500	5,087	178,045	.705
Small-scale hand methods:						
Wet:						
1945	26		12,800	645	22,575	1.764
1946	51		18,800	688	24,080	1.281
1947	44		46,600	1,121	39,235	.842
1948	59		53,300	984	34,440	.646
1949	50		55,330	693	24,255	.438
Underground placers:						
Drift:						
1945	1		1,500	362	12,670	8.447
1946	2		200	16	560	2.800
1947	3		400	48	1,680	4.200
1948	4		700	88	3,080	4.400
1949	2		170	24	840	4.941
Grand total placers:						
1945	[2] 143		4,512,000	57,708	2,019,780	.448
1946	[2] 256		14,108,000	220,708	7,724,780	.548
1947	[2] 260		13,866,000	276,443	9,675,505	.698
1948	[2] 274		16,744,000	242,802	8,498,070	.508
1949	[2] 222		18,363,000	221,089	7,738,115	.421

[1] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

Silver.—Of the silver produced in Alaska in 1949, 90 percent was a byproduct of gold mining (55 percent in 1948) and 10 percent came from lead ore. The most important producer of silver in Alaska in 1949 was the United States Smelting, Refining & Mining Co. (Fairbanks department), which recovered silver as a byproduct of bucket-line dredging operations in the Fairbanks district. The J. H. Scott Co., which dropped from first place in 1948 to second in 1949, recovered silver as a byproduct from lead ore produced from the Riverside mine in the Hyder district, Southeastern Alaska region.

Copper, Lead, and Zinc.—Production of the base metals (copper, lead, and zinc) was limited almost entirely to output from one mine, the Riverside, near Hyder in Southeastern Alaska. A relatively small output of the metals came from several other properties in the same region as a byproduct recovery from ore and old tailings treated primarily for the recovery of gold.

Mine production of gold, silver, copper, lead, and zinc in Alaska in 1949, by months, in terms of recoverable metals [1]

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January					
February	19	7			
March	30	4			
April	654	300			
May	10,302	1,488		2	(2)
June	21,858	3,279		1	(2)
July	24,253	3,457			
August	37,730	5,667			
September	34,387	5,833		22	(2)
October	59,101	9,508	2	15	(2)
November	21,190	3,534	2	11	(2)
December	19,892	2,979			(2)
Total: 1949	229,416	36,056	4	51	2
1948	248,395	67,341	16	329	22

[1] Based on mint and smelter receipts; data are adjusted to exclude receipts during the first part of 1949 previously credited to 1948 production, and to include receipts in 1950 which are a part of actual output in 1949.
[2] Less than ½ ton.

Mine production of gold, silver, copper, lead, and zinc in Alaska in 1949, by regions, in terms of recoverable metals [1]

Region	Mines producing [1]		Gold (fine ounces)			Silver (lode and placer, fine ounces)	Total value
	Lode	Placer	Lode	Placer	Total		
Cook Inlet-Susitna	4	15	5,071	2,258	7,329	646	$257,100
Copper River	1	4	4	114	118	20	4,148
Kenai Peninsula	2		127		127	34	4,476
Kodiak Island	1		1		1	1	36
Kuskokwim		6		11,626	11,626	921	407,744
Seward Peninsula and Northwestern Alaska [2]		63		56,028	56,028	6,285	1,966,668
Southeastern Alaska	7	1	2,917	8	2,925	4,749	[3] 124,861
Yukon River Basin	3	133	207	151,055	151,262	23,400	5,315,348
Total Alaska: 1949	18	222	8,327	221,089	229,416	36,056	[3] 8,080,381
1948	24	274	5,593	242,802	248,395	67,341	[4] 8,885,350

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Combined to avoid disclosure of individual output.
[3] Includes value of 4 short tons of copper ($1,576), 51 tons of lead ($16,116), and 2 tons of zinc ($496).
[4] Includes value of 16 short tons of copper ($6,944), 329 tons of lead ($217,782), and 22 tons of zinc ($5,582).

MINING INDUSTRY

Two fewer bucket-line dredges (28 in 1949 compared with 30 in 1948) washed 79 percent of the total gravel mined for gold in Alaska in 1949 and recovered 71 percent of the total placer gold and 68 percent of the total Alaska gold (lode and placer). No dragline dredges (which include all operations using a floating washing plant and a dragline excavator) were reported in operation during 1949. Placer operations using combinations of bulldozer and hydraulic methods—in many cases supplemented with dragline equipment—are becoming more numerous in the Territory because of the distinct advantage of relatively low initial cost of equipment in proportion to the small labor crews necessary and the large volume of material that can be handled. In general, the mining method is to bulldoze the gold-bearing material to bedrock sluice boxes and use hydraulic giants (usually in closed circuit with a settling pond downstream below the sluice box, and a pump for return of the water). Dragline equipment—when used—is generally utilized for disposing of tailings and in some cases for transporting gravel to elevated sluice boxes or washing plants. Occasionally draglines or bulldozers are used for removing overburden, but by far the greater proportion of the overburden, in the form of frozen muck, is washed off with hydraulic giants. Combination methods of this type, in which the gravel is moved mechanically to the washing plant or sluice box (classified as nonfloating washing plants), washed 19 percent of the total gravel mined and recovered 27 percent of the placer gold, a 19-percent decrease in gravel handled and a 2-percent gain in gold recovered compared with 1948. Operations in which gold was recovered primarily by hydraulic methods (excluding hydraulic stripping of overburden) showed a decrease in the number of mines (partly because of reclassification from hydraulic to nonfloating washing plants), gravel washed, and gold produced. Gold output from a smaller number of small-scale hand operations was correspondingly less than in 1948. Two drift mines produced only a few ounces of gold in 1949; this method of mining, once widespread in Alaska, is now virtually obsolete. The total yardage of gravel washed at gold placer mines increased 10 percent, whereas gold recovered declined 9 percent. The average recoverable gold content of gravel decreased 17 percent.

The tonnage of material from lode mines (gold, silver, copper, lead, and zinc) in Alaska treated in 1949 apparently increased to 13 times the total for 1948. However, this marked increase is due largely to inclusion of a large tonnage of old tailings, for which comparable figures for 1948 are not available, although a substantial tonnage of similar material was known to have been treated in that year. The output of lode gold increased 49 percent, largely because of resumption of operations of the Independence mine, Willow Creek district, Cook Inlet-Susitna region; however, gold from all active lode mines and mill clean-ups at inactive mines comprised only 4 percent of the Territory total.

ORE CLASSIFICATION

Of the 78,839 tons of ore (including 70,026 tons of old tailings) sold or treated in 1949, 97 percent was gold ore and the remainder lead ore. Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore and old tailings sold or treated in Alaska in 1949, with content in terms of recoverable metals

Source	Material sold or treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
Dry gold ore	6,713	70,026	7,983	1,372	100	600	200
Lead ore	2,100		344	3,739	7,900	101,400	3,800
Total lode mines	8,813	70,026	8,327	5,111	8,000	102,000	4,000
Placers			221,089	30,945			
Total: 1949	8,813	70,026	229,416	36,056	8,000	102,000	4,000
1948	[1] 5,848	166	248,395	67,341	32,000	658,000	44,000

[1] Includes 80 tons of ore produced before 1948.

METALLURGIC INDUSTRY

Of the total ore and old tailings handled during 1949, all was treated at mills (with or without concentrating equipment) except a small tonnage shipped for direct smelting; 97 percent was treated by amalgamation. Smelters in the United States received 340 tons of flotation concentrates, 46 tons of gravity concentrates, and 14 tons of ore for direct smelting from Alaska operations of mines producing gold and lead (with silver, copper, and zinc as byproducts).

Mine production of metals in Alaska in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore and old tailings amalgamated	7,131	851			
Concentrates smelted:					
Flotation	878	3,832	7,900	101,400	3,800
Gravity	252	313	100	600	200
Ore smelted	66	115			
Total lode mines	8,327	5,111	8,000	102,000	4,000
Placers	221,089	30,945			
Total: 1949	229,416	36,056	8,000	102,000	4,000
1948	248,395	67,341	32,000	658,000	44,000

Mine production of metals from mills in Alaska in 1949, by regions, in terms of recoverable metals

	Material treated		Recoverable in bullion		Concentrates smelted and recoverable metal					
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY REGIONS										
Cook Inlet-Susitna	5,416		4,626	261	57	445	38			
Copper River	Clean-up.		1		(1)	2				
Kenai Peninsula	120		105	28	(1)	22	6			
Southeastern Alaska	2,800	70,026	2,192	532	329	661	4,101	8,000	102,000	4,000
Yukon River Basin	463		207	30						
Total: 1949	8,799	70,026	7,131	851	386	1,130	4,145	8,000	102,000	4,000
1948	[2] 5,822	15	4,196	736	1,005	1,220	30,352	28,000	656,500	44,000
BY CLASSES OF CONCENTRATES										
Dry gold					106	786	406	100	600	200
Lead					280	344	3,739	7,900	101,400	3,800
Total 1949					386	1,130	4,145	8,000	102,000	4,000

[1] Less than ½ ton.
[2] Includes 89 tons of ore produced before 1948.

Gross metal content of concentrates produced from ores mined in Alaska in 1949, by classes of concentrates

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	106	786	406	592	1,172	271
Lead	280	344	3,739	8,539	104,113	4,494
Total: 1949	386	1,130	4,145	9,131	105,285	4,765
1948	1,005	1,220	30,352	34,073	672,475	52,047

Mine production of metals from Alaska crude ore and old tailings shipped to smelters in 1949, by regions, in terms of recoverable metals

Region	Material treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
	Ore (short tons)	Old tailings (short tons)				
Copper River	1		1			
Kodiak Island	6		1	1		
Southeastern Alaska	7		64	114		
Total: 1949	[1] 14		66	115		
1948	26	151	177	288	4,000	1,500

[1] All dry gold.

Gross metal content of Alaska crude ore and old tailings shipped to smelters in 1949, by classes of material

Class of material	Material treated		Gross metal content			
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Dry gold	14		66	115	43	
Total: 1949	14		66	115	43	
1948	26	151	177	288	4,341	2,130

REVIEW BY REGIONS AND DISTRICTS

There is no official record for a considerable quantity of natural gold produced in Alaska in 1949 and sold on the open market for prices over $35 a fine ounce, inasmuch as some producers did not submit reports and the purchasers are holding such gold on speculation. The recorded production of gold from a few of the districts in 1949 (including the Fairbanks, Fortymile, Circle, Eagle, Kantishna, Innoko, Rampart, and Tolovana districts in the Yukon River Basin region, and the Council-Bluff district in the Seward Peninsula region, from which natural gold was reported as having been sold) is probably lower than the actual output by several hundred to several thousand ounces, and there is some question as to the relative rank in production of the individual operators.

Mine production of gold, silver, copper, lead, and zinc in Alaska in 1949, by regions and districts, in terms of recoverable metals [1]

Region and district	Mines producing [2]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver [3] (lode and placer, fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Cook Inlet-Susitna region:											
Valdez		1			25	25	4				$879
Willow Creek	4	(4)	5,416	5,071	(4)	[5] 5,071	[5] 299				[5] 177,756
Yentna-Cache Creek		13			2,229	2,229	843				78,325
Copper River region:											
Prince William Sound	1		1	4		4					140
Yakataga		1			32	32	1				1,121
Kenai Peninsula region: Moose Pass-Hope	2		120	127		127	34				4,476
Kodiak Island region: Kodiak Island	1		6	1		1	1				36
Kuskokwim region:											
Goodnews Bay		1			(6)	(6)	(6)				(6)
Tuluksak-Aniak		5			11,626	11,626	921				407,744
Seward Peninsula region:											
Council-Bluff		7			3,750	3,750	437				131,646
Fairhaven		10			9,335	9,335	1,187				327,799
Kougarok		17			8,265	8,265	790				289,990
Nome		22			32,303	32,303	3,554				1,133,822
Port Clarence		3			166	166	19				5,827
Serpentine River		1			69	69	7				2,421
Southeastern Alaska region:											
Hyder	1		2,100	151		151	3,500	7,700	97,000	3,800	25,767
Juneau	4	1	70,101	2,426	8	2,434	820	300	4,900	200	86,700
Yukon River Basin region:											
Bonnifield-Nenana		4			188	188	33				6,610
Chandalar		3			97	97	10				3,412
Circle		10			10,426	10,426	1,602				366,360
Eagle		3			1,552	1,552	101				54,411
Fairbanks	3	20	463	207	95,020	95,227	14,471				3,346,042
Fortymile		18			7,114	7,114	754				249,672
Hot Springs		9			1,967	1,967	489				69,288
Iditarod		12			9,157	9,157	1,426				321,786

Innoko		12			7,134	7,134	1,039				[illegible]
Kantishna		5			768	768	196				27,057
Koyukuk		15			2,224	2,224	228				78,046
Marshall		1			2,277	2,277	205				79,962
Rampart		7			1,688	1.688	237				59,295
Ruby		7			3,758	3,758	745				122,204
Tolovana		5			3,021	3,021	297				106,004
Other districts [7]	2	9	632	340	6,890	7,230	2,207		100		255,063
Total Alaska	18	222	78,839	8,327	221,089	229,416	36,056	8,000	102,000	4,000	8,080,381

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; others producing listed in footnote 7 and their output included with "Other districts."
[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[3] Sources of total silver as follows: 5,111 ounces from lode mines, and 30,945 from placers.
[4] Included with "Other districts."
[5] Exclusive of placer output, which is included with "Other districts."
[6] Gold not sold.
[7] Includes following: Willow Creek (placer) Cook Inlet-Susitna region; Chistochina and Nelchina (placer) Copper River region; Kiana (placer) Northwestern Alaska region; Koyuk (placer) Seward Peninsula region; Ketchikan (lode) Southeastern Alaska region; Hughes, Kaiyuh (placer) Yukon River Basin region.

COOK INLET-SUSITNA REGION

Willow Creek District.—The Alaska Pacific Consolidated Mining Co. reopened the Independence mine on Fishhook Creek near Wasilla late in the season after being inactive since 1946. The mine was operated on a leasing system, the ore being treated at the company 80-ton amalgamation-flotation mill on the property. From 4,366 tons of gold ore milled from August 18 to December 31, 3,018 ounces of gold and 179 ounces of silver were recovered as bullion by amalgamation; in addition, 42 tons of concentrate (containing 333 ounces of gold, 31 ounces of silver, and 199 pounds of copper) were produced and shipped to a smelter in the United States. The Fern Exploration Co., Inc., operated the Fern mine on Archangel Creek throughout the year; 800 tons of gold ore were treated in a 50-ton amalgamation-flotation mill to recover 1,381 ounces of gold and 63 ounces of silver as bullion and an additional 80 ounces of gold and 6 ounces of silver contained in 11 tons of concentrate shipped to a smelter in the United States. Lloyd Hill recovered a small quantity of gold from gold ore treated by amalgamation at the Lonesome mine (Gold Mint property) on the Little Susitna River. A small quantity of gold was recovered as the result of clean-up operations at the Gold Cord mill on Fishhook Creek. Development work continued throughout 1949 at the Snowbird mine on Reed Creek. A 30-ton mill and power plant were constructed during the year, but no ore had been treated by December 31.

Yentna-Cache Creek District.—Again, as in 1948, the largest producer in the district was Collinsville Mines (dryland dredge with dragline equipment) operating on Twin Creek. The Alaska Exploration and Mining Co. hydraulicked 15,000 cubic yards of gravel on Bird Creek from May 1 to October 6 and recovered 245 ounces of gold and 36 ounces of silver. Harold Stanton recovered a moderate quantity of gold by the combination bulldozer-hydraulic method on Nugget Creek from May 28 to September 5; the ground, under lease from the Nugget Creek Mining Co., was reportedly worked out at the end of the season. A few other operators recovered lesser quantities of gold by hydraulicking and the widely used bulldozer-hydraulic combination.

COPPER RIVER REGION

Chistochina District.—Activity in the district was virtually at a standstill in 1949. Hagarty and Beerman operated the Big Four mine on Big Four Creek from June 22 to August 31 and recovered a small quantity of gold by the bulldozer-hydraulic method. The Slate Creek Gold Placers, the largest producer in the district in 1948, did not operate during the 1949 season.

Nelchina District.—C. J. McMahan was the only operator reported active in the district in 1949; he recovered a small quantity of gold from North and Albert Creeks, using a carry-all-bulldozer combination to move gravel to the sluice box.

KENAI PENINSULA REGION

Moose Pass-Hope District.—The Skeen-Lechner (Falls Creek) mine was operated by the Falls Creek Mining Co. from July 1 to October 15,

1949; 110 tons of gold ore were treated in the 25-ton amalgamation flotation plant at the mine and 98 ounces of gold and 27 ounces of silver were recovered in the form of bullion. In addition, less than one-half ton of concentrate containing 22 ounces of gold and 6 ounces of silver was shipped to a smelter in the United States. William Kelly operated the Grant Lake mine during the season and recovered a small quantity of gold from gold ore treated by amalgamation.

KUSKOKWIM REGION

Goodnews Bay District.—The only gold produced in the district in 1949 was recovered as a byproduct from platinum mined by the Goodnews Bay Mining Co. on the Salmon River.

Tuluksak-Aniak District.—The New York-Alaska Gold Dredging Corp., the largest gold producer in the region and the third largest in the Territory in 1949, operated two floating bucket-line dredges (electrically powered, equipped with sixty-seven 6½-cubic-foot and sixty-six 1½-cubic-foot buckets, respectively) and a dragline-bulldozer combination with a nonfloating washing plant on the Tuluksak River and Bear and California Creeks. The Marvel Creek Mining Co., using a dragline-bulldozer-hydraulic combination with nonfloating washing plant on Marvel Creek from June 1 to October 15, washed 100,000 cubic yards of gravel to recover 1,133 ounces of gold and 144 ounces of silver. Using a bulldozer-hydraulic combination with a nonfloating washing plant, the Canyon Creek Mining Co. (Jens Kvamme & Sons) recovered a substantial quantity of gold from Canyon Creek from July 1 to September 5.

NORTHWESTERN ALASKA REGION

Kiana District.—The Lammers Exploration Co., the only gold producer in the district in 1949, operated its Diesel-electric bucket-line dredge (with fifty-six 3-cubic-foot buckets) on Klery Creek during the 1949 season.

SEWARD PENINSULA REGION

In the Seward Peninsula region, 14 floating bucket-line dredges were in operation during 1949 (the same number as in 1948); in addition, numerous operators used hydraulic giants, bulldozers, and dragline excavators either separately or in combination. There was no reported production from any lode gold mine.

Council-Bluff District.—The principal producers in the district were the Alaska Placer Co., which operated a bucket-line dredge (flume type, equipped with sixty 3-cubic-foot buckets) on the Niukluk River benches (2,101 ounces of gold and 239 ounces of silver were recovered from 250,000 yards of gravel washed during the period from June 12 to October 5), and the Sourdough Dredging Co., which operated a bucket-line dredge equipped with sixty-two 3½-cubic-foot buckets on Dutch and Ophir Creeks July through October 1949. The Council Dredging Co. operated a bucket-line dredge on Ophir Creek during the 1949 season—the first appearance of this company among the producers in the district since the war. C. L. Dempsey recovered a small quantity of gold from Willow Creek, using a bucket-line dredge.

Among other operators in the district using different methods, the Niukluk Mining Co. was the principal producer of placer gold.

Fairhaven District.—The Havenstrite Mining Co. (formerly known as Arctic Circle Exploration Co.), operating two drag-line excavators (each with 1½-cubic-yard buckets) for the movement of tailings and three bulldozers for delivering gravel to the sluice box on Candle Creek, recovered 4,255 ounces of gold and 591 ounces of silver from 90,162 cubic yards of material washed between April 20 to November 6. The operation ranked first in production of gold in the district and seventh in the Territory. Neither of the two bucket-line dredges formerly owned by the predecessor company was operated in 1949. The Casa de Paga Gold Co. operated its two bucket-line dredges on the Inmachuk River from May 1 to October 30 and recovered 3,700 ounces of gold and 388 ounces of silver from 365,410 cubic yards of gravel. Both dredges are the flume type, equipped with seventy 3-cubic-foot buckets. Other producers of a moderate quantity of gold from placers worked hydraulically and in combination with bulldozers, pumps, or other types of mechanical equipment included N. B. Tweet & Sons (bulldozer-hydraulic on Humboldt Creek); Wallace Porter (bulldozer-hydraulic on claim 3 below Discovery on Bear Creek; 374 ounces of gold and 34 ounces of silver recovered from 30,000 cubic yards); Jump Creek Mines (Fred Weinard, hydraulic on Jump Creek); and Anderson & Luoto on Old Glory Creek (99 ounces of gold and 10 ounces of silver recovered from 7,200 cubic yards of gravel handled by a bulldozer-hydraulic combination).

Kougarok District.—Kougarok Consolidated Placers, Inc., operating its Diesel-powered dredge (with seventy-six 2¼-cubic-foot buckets) on claims 29, 30, and 31 above Allen's Discovery, Kougarok River, from July 15 to October 18, was the largest producer of gold in the district in 1949. The North Fork Dredging Co. operated its bucket-line dredge (with 2½-cubic-foot buckets) on Harris Creek during the season and recovered a substantial quantity of gold. Other mining in the district in 1949 was limited to placer operations, principally by hydraulicking and with combinations of mechanical equipment using nonfloating washing plants (in most cases bedrock sluice boxes). The large operators were Grant Mining Co. (hydraulic on Coffee Creek); Trinity Mining Co. (John Kanari and Al Carey—bulldozer on Kougarok River), Noonan & Whitmore (bulldozer-hydraulic with elevated sluice box on Mascot Gulch) on the M. J. Walsh property, Atlas Mines (Geo. J. Waldhelm—dragline-bulldozer-hydraulic on Atlas Creek), Nashenweng & Asp (hydraulic-bulldozer on claim 8, Quartz Creek), Silver Bow Mining Co. on Coffee Creek, and Wirum Bros. also on Coffee Creek (hydraulic on claim 4 above Crause's Discovery).

Koyuk District.—James E. Baldwin recovered a substantial quantity of gold from the Right Fork Sweepstake Creek during the period July 1 to October 3, using bulldozer-hydraulic equipment. The bucket-line dredge of the Ungalik Syndicate did not operate during the 1949 season.

Nome District.—The United States Smelting, Refining & Mining Co., operating two of its fleet of four bucket-line dredges in the vicinity of Nome from May 27 to December 3, was the largest producer of

gold in the district and the Seward Peninsula region and ranked second in the Territory. The two dredges in operation were electrically powered and equipped with 134 and 109 9-cubic-foot buckets, respectively. Lee Bros. Dredging Co., the second-largest gold producer in the district in 1949, operated two bucket-line dredges (equipped with seventy-three 5-cubic-foot and sixty-six 3½-cubic-foot buckets) on the Solomon River during the 1949 season. The two other bucket-line dredges active in the district during 1949 were operated by Gold Beach Dredging Co. (Childberg claim, Nome Beach) and Tolbert Scott & Son (Iron Creek). Among the larger producers of 100 ounces or more of gold from placers worked by hydraulic giants and in combination with bulldozers and pumping equipment were E. W. Quigley on Solomon River (hydraulic), Andrew Peterson on Iron Creek, Kougarok Freighting & Mining Co. on Buster Creek (bulldozer-hydraulic), and Rocky Mountain Mining Co. on Rocky Mountain Creek (bulldozer-hydraulic).

Port Clarence District.—O'Leary & Co. hydraulicked on the Bluestone River during the 1949 season and recovered a small quantity of gold, using equipment obtained from the Glacier Creek Mines (which had operated on Glacier Creek, Nome District, in 1948). Frank L. Rice used hydraulic-bulldozer equipment on Sunset Creek to recover a moderate quantity of gold during a 50-day operating period.

Serpentine River District.—George Bodis worked the Dick Creek Placers (No. 12 above Discovery) from July 1 to October 1. Using a bulldozer-hydraulic combination with a bed-rock flume, 69 ounces of gold and 7 ounces of silver were recovered from 3,000 cubic yards of gravel.

SOUTHEASTERN ALASKA REGION

One-third of the total Alaska lode-gold output came from seven operations in the Hyder, Juneau, and Ketchikan districts. Nearly all of the lode silver and all of the copper, lead, and zinc came from this region. Placer mining was virtually nonexistent during 1949, as in 1948.

Hyder District.—The J. H. Scott Co. operated the Riverside mine on a reduced scale from August 15 to December 1 treating lead ore (containing scheelite) in its 100-ton combination flotation-gravity concentration mill. From 2,100 tons of lead ore milled, 265 tons of lead concentrate (containing 151 ounces of gold, 3,500 ounces of silver, 8,335 pounds of copper, 99,441 pounds of lead, and 4,494 pounds of zinc) were produced and shipped to smelters in the United States.

Juneau District.—The Alaska Juneau mine remained inactive during 1949, but a few tons of lead concentrate containing some gold and silver obtained as the result of mill clean-up was shipped to a smelter in the United States. Howard Hayes & Stan Whitely recovered 1,581 ounces of gold and 301 ounces of silver in the form of bullion by retreating 65,500 tons of old tailings from the Alaska Juneau mill by amalgamation; in addition, 29 tons of gravity concentrate containing 146 ounces of gold, 74 ounces of silver, 137 pounds of copper, and 995 pounds of lead were shipped to a smelter in the United States. The same partners similarly recovered 115 ounces of gold and 12 ounces of silver from 4,500 tons of old tailings from the Treadwell mill. The

LeRoy Mining Co. operated the LeRoy (Rainbow) mine on Glacier Bay from April 1 to October 24 and treated gold ore in an 18-ton amalgamation-flotation mill; from 75 tons of ore and 26 tons of old tailings milled, 324 ounces of gold and 143 ounces of silver were recovered as mill bullion, and 3 tons of concentrate were produced (containing 67 ounces of gold, 49 ounces of silver, 4 pounds of copper, 34 pounds of lead, and 271 pounds of zinc) and shipped to a smelter in the United States.

Ketchikan District.—The only active gold mine in the district in 1949 was the Dawson mine on Prince of Wales Island, operated by Wendell Dawson from March 7 to November 12; gold ore was treated by amalgamation, and a small tonnage of ore and concentrate was shipped to a smelter in the United States.

YUKON RIVER BASIN REGION

One hundred and thirty-three placer mines and 3 lode mines in 17 districts in the Yukon River Basin region accounted for 66 percent of the total Alaskan gold produced in 1949. Sixty-nine percent of the 151,055 ounces of placer gold produced in the region came from 10 bucket-line dredges. Two percent of the total Alaska gold from lode mines came from the region. The Fairbanks district continued to be the most important gold-producing area in the region and the Territory.

Circle District.—Two bucket-line dredges were active in the district in 1949. Alluvial Golds, Inc., operated its Diesel-powered dredge equipped with seventy-two 4½-cubic-foot buckets on Woodchopper Creek from April 16 to October 11. The C. J. Berry Dredging Co., operating its dredge on Mammoth Creek, washed 352,500 cubic yards of gravel to recover 3,920 ounces of gold and 787 ounces of silver. Gold Placers, Inc., did not operate its dredge on Coal Creek during 1949; the season was spent in stripping overburden preparatory to resumption of production in 1950. The output from the two active dredges constituted the greater part of the production from the district, which ranked second in gold production in the Yukon River Basin region. The larger producers of placer gold in the district by other methods were P. R. & H. Mining Co., on lower Deadwood Creek (1,559 ounces of gold and 381 ounces of silver recovered from 110,000 cubic yards of material handled by the bulldozer-sluice box method); Deadwood Mining Co., on upper Deadwood Creek (490 ounces of gold and 74 ounces of silver recovered from 20,000 cubic yards of gravel by the combination dragline-bulldozer-hydraulic method); Kelly & Wilkinson, on Miller Creek (481 ounces of gold and 87 ounces of silver from 45,000 cubic yards of material handled; bulldozer-hydraulic); Frasca & Gibson, on Eagle Creek (bulldozer-hydraulic); Harrison Creek Mining Co., on Harrison Creek (hydraulic); and A. A. Zimmerman, on Independence Creek (hydraulic).

Eagle District.—The Yukon Placer Mining Co., using bulldozer equipment, worked placer ground on Fourth of July Creek from April 15 to September 30 and recovered 1,372 ounces of gold and some silver from 70,000 cubic yards of gravel. Burnett F. Hansen, using similar equipment, operated on Alder Creek. The Crooked Creek

Placer Co. (Bauer & Celich) hydraulicked on Crooked Creek from April 15 to September 30 and recovered 80 ounces of gold and 6 ounces of silver from 2,700 cubic yards of gold-bearing gravel washed.

Fairbanks District.—The United States Smelting, Refining & Mining Co., operating five bucket-line dredges in the Fairbanks district, was—as in previous years—by far the largest producer of gold, not only in the district but in the Territory. The company operated three 6-cubic-foot Bethlehem dredges (1 with 68 buckets and 2 with 78 buckets each), one 10-cubic-foot Bethlehem dredge (with 93 buckets), and one 10-cubic-foot Yuba dredge (with 106 buckets); all dredges are operated electrically. Other equipment used (chiefly for removing overburden) included 240 Joshua Hendy hydraulic giants, a Bucyrus 10–W power shovel, and numerous bulldozers and carryalls.

The Brinker-Johnson Co., the second largest producer in the Fairbanks district, recovered 8,747 ounces of gold and 1,110 ounces of silver from 671,164 cubic yards of gravel handled by a Walter Johnson Diesel-powered bucket-line dredge equipped with seventy-eight 4½-cubic-foot buckets on Caribou Creek (in the Salcha area).

Of those producers of gold from placers worked hydraulically and in combination with draglines, bulldozers, and pumping equipment, the Alder Creek Mining Co. was the largest. Two dragline excavators (with 1½- and 2-cubic-yard buckets, respectively), three bulldozers, and four hydraulic giants were used by the company during the 1949 season on Fairbanks Creek from May 5 to October 15. Other producers of a substantial quantity of placer gold in the district, using similar combinations of equipment, were Four A Mining Co. on Pedro Creek (bulldozer-hydraulic), Helmer Johnson on Cleary Creek from May 10 to October 12 (hydraulic with bulldozer equipment), G. B. Martin on Pedro Creek (bulldozer-hydraulic), Ernest L. Maurer on Last Chance Creek (bulldozer-hydraulic), Strom Co. on Rose Creek (dragline-bulldozer-hydraulic), Wildt & Townley on Homestake Creek (bulldozer-hydraulic), and Williams Mining Co. on Gilmore Creek.

Production of gold from lode mines in the Fairbanks district in 1949 was even smaller than has been usual during the postwar period of high costs for labor, supplies, and equipment. Only three operators reported activity during the season. Jokela & Lazeration worked the Greenback claims on Pedro Dome at the head of Little Eldorado Creek and recovered a moderate quantity of gold from gold ore treated by amalgamation at the Cleary Hill Mines Co. mill on Cleary Creek. E. L. Kay operated the Lone Tree (Sanford) mine on Ester Dome during a 7-month period in 1949. Howard Sparks recovered a small quantity of gold as a byproduct of antimony mining and milling at the Tolovana mine on Willow Creek during July 1949.

Fortymile District.—Of the placer gold reported recovered in the district in 1949 (excluding that quantity of natural gold concerning which records are incomplete), 81 percent came from properties operated by the Yukon Placer Mining Co. on Canyon Creek (1,946 ounces of gold and some silver recovered from 94,000 cubic yards of gravel by the use of a bucket-line dredge equipped with fifty-eight 2½-cubic-foot buckets) and Walker's Fork (248 ounces of gold and 38 ounces of silver recovered from 26,000 cubic yards of gravel by the

use of bulldozers and a sluice box), and the Wade Creek Dredging Co. on Wade Creek (3,566 ounces of gold and some silver recovered by the bulldozer-sluice box method from 189,000 cubic yards of gravel). A substantial quantity of gold also was produced by the Franklin Mining Co. from the Meldrum property on Chicken Creek (bulldozer-hydraulic) and the Uhler Creek Mining Co. on Uhler Creek. Several other producers in the area, using similar equipment, reported outputs of less than 200 ounces of gold.

Hot Springs District.—The largest producer of gold in the district in 1949 (on the basis of reported output for all producers excluding natural gold sold, quantity unreported) was A. W. Pringle, who operated on Rhode Island Creek (bulldozer-hydraulic). Other producers in the district with reported outputs of 100 to 400 ounces of gold, using various combination of bulldozers, hydraulic equipment, and draglines with bedrock sluice boxes, were Cleary Hill Mines Co. on Sullivan Creek and Tofty Gulch, Coble & Francis and Pete Johnson on Eureka Creek, Johnson & Johnson on Glenn Gulch, Enstrom & McDougall on American Creek, and Doyle & Conners on New York Creek. Otto Hoverly worked a small drift mine on Cache Creek (Cannon Ball 1, 2, 3, and 4 claims) near Tofty.

Hughes District.—Only one producer reported activity in the district in 1949. Strandberg & Sons, using dragline-bulldozer-hydraulic equipment, recovered a substantial quantity of gold from Utopia Creek.

Iditarod District.—The largest producer of gold in the district in 1949, as in 1948 (on the basis of reported data), was the North American Dredging Co., which operated its Diesel-powered bucket-line dredge equipped with seventy 3½-cubic-yard buckets on the Mohawk Association property on Otter and Flat Creeks between June 10 and October 18. Among the larger operators which produced placer gold with dragline-bulldozer-hydraulic equipment were Hatton & Turner on Willow Creek, Awe Mining Co. on Chicken Creek, Uotila & Ogriz on Slate Creek, Moore Creek Mining Co. on Moore Creek, and the Alpha Mining Co. on Alpha Association property on Flat Creek. The Prince Creek Mining Co. on Prince Creek and Gust Backstrom on Flat Creek recovered a moderate quantity of gold by hydraulicking.

Innoko District.—Several thousand ounces of natural gold produced from the Innoko district in 1949 were sold on the open market; but, inasmuch as only part of this output was reported, the relative rank in output of each producer is in doubt. On the basis of known data the principal operators of placer-gold mines in the district in 1949—all of which used dragline-bulldozer-hydraulic equipment in conjunction with a sluice box, either of the bedrock or elevated type—were Cripple Creek Mining Co. (Strandberg & Sons) on Cripple Creek, Degnan Mining Co. on Little Creek, Gurther & Myklebust on Little Creek and (N. J. Vibe estate) Anvil Creek, Hard & Uotila on Bear Creek, Hubbard & McFarland on Little Creek and Lower Ganes Creek, Rosander & Reed on Yankee Creek, Savage & Matheson on Spruce Creek, and Uotila & Hard on Ophir Creek. The mining season in the district lasted about 5½ months, from early May to mid-October.

The Innoko Dredging Co. (Repo & Molitor, lessees) was rebuilding the bucket-line dredge on Ganes Creek during 1949; the boat will be Diesel-powered and equipped with seventy 3½-cubic-foot buckets.

Kantishna District.—The Glacier Creek Mining Co. operated on Glacier Creek from June 15 to September 10, using the dragline-bulldozer-dry-land washing plant equipment leased from Caribou Mines. The ground on Caribou Creek and Glacier Creek is considered to be worked out, and neither company plans to resume operation in the area. Hosler Mines operated on Eureka Creek (bulldozer-hydraulic) from June 25 to September 10; and Hunter & Burnett, using similar equipment, recovered a moderate quantity of gold from its property on Crooked Creek.

Koyukuk District.—The South Fork Mining Co. again—as in 1948—was the largest producer of gold in the district. Operating its dragline-bulldozer combination with a bedrock sluice on gold bench, on the South Fork of Koyukuk River from April 15 to September 1, 800 ounces of gold and 82 ounces of silver were recovered from 43,000 cubic yards of gravel. Using the same type of equipment, the Myrtle Creek Mining Co. operated on Myrtle Creek in 1949. Another producer of a moderate quantity of gold, but with bulldozer-hydraulic equipment, was the Wild Lake Mining Co. (Savage & Doheny) which operated on Spring Creek from June 15 to August 31. Other producers of smaller quantities of gold in the district (on the basis of reported data) included A & S Mining Co. on Crevice Creek, Nesland & White on Vermont and Portage Creeks (bulldozer), E. H. Pitts on Lake Creek (hydraulic), Stanich Bros. on Porcupine Creek, and Bill Vurcich on Sheep Creek.

Marshall District.—Johnson & Ostnes operated a dry-land dredge (dragline and movable elevated washing plant) on claims 2 and 3 below Discovery on Willow Creek from June 1 to October 4.

Rampart District.—The Little Minook Mining Co. operated on Little Minook Creek during the 1949 season from May 15 to September 29 and recovered 1,454 ounces of gold and 205 ounces of silver from 88,000 cubic yards of gravel, using a dragline-bulldozer-hydraulic combination. Hunter Creek Mining Co. produced 207 ounces of natural gold from Hunter Creek by the bulldozer-hydraulic method from July 12 to August 28; but the greater part of the output was not sold. A substantial quantity of gold was produced by Swanson Bros. & Saarela on Hunter Creek from May through September 15, using bulldozers and a sluice plate. Pierce & Cravey operated on Gunnison Creek and recovered a moderate quantity of gold. Frank J. Dinan worked claim 2 below Discovery on Florida Creek by drift mining.

Ruby District.—Peter Miscovich & Sons, using a dragline-bulldozer-pump combination on Flat Creek, June through October 11, was the largest gold producer in the district in 1949. The Iditarod Operating Co., operating on Golden Creek, 30 miles south of Tanana, from July 1 to September 25, recovered 780 ounces of gold and 96 ounces of silver from 129,400 cubic yards of gravel handled by bulldozers and washed over a bed-rock sluice plate. Other producers of substantial quantities of gold in the district using similar type of equipment, some with a dragline, were Granite Creek Mining Co. (Carlo & May) on Ophir Creek; Iver Johnson & Co. on Trail Creek; Midnight Mining Co.

(Coyle & Rasmussen), operating the Enterprise and Rabbit Fraction claims on Midnight Creek (Fox Association); and Clarence Zaiser on Spruce Creek.

Tolovana District.—Olive Creek Mines (as in 1948) was the largest producer of gold in the district; 1,705 ounces of gold and 178 ounces of silver were recovered from 70,000 cubic yards of gold-bearing gravel handled by the commonly used bulldozer-pump-sluice-box method, the tailings being removed by a dragline. The operation was on the N. R. Hudson property on Olive Creek near Livengood. Warwick Mines, using a bulldozer-hydraulic combination on Gertrude Creek from May 1 to October 5, recovered 618 ounces of gold and some silver from 140,000 cubic yards of gravel. The Amy Creek Mining Co., using the bulldozer-hydraulic combination to handle gravel, a sluice box, and a dragline to remove tailings, operated on Amy Creek bench from April 18 to September 18. Wilbur Mines operated on Wilbur Creek (bulldozer-hydraulic) during a 4-month period, and Car, Jurich & Mandish hydraulicked on Lillian Creek from June 1 to August 31.

OTHER MINERALS

Antimony.—Earl Pilgrim operated the Stampede mine in the Kantishna district and was the only producer reporting shipments of antimony ore or concentrates from Alaska in 1949. Shipments were 74 tons of concentrate containing 87,780 pounds of antimony. The Sawtooth Mining Co. suspended its development program at an antimony occurrence near Rampart; 100 tons of 50-percent antimony ore mined in 1948 was still at the property pending advantageous market conditions for shipment. The Antimony Corp. of Alaska produced a small tonnage of antimony ore from the Rambler mine on Boulder Creek in the Tok district; no shipments were made to the United States. Howard Sparks developed the Tolovana mine, Fairbanks district, and set up a small flotation plant for antimony concentrate; no shipments were made.

Coal.—Alaska produced 455,000 short tons (preliminary figure) of bituminous coal and lignite in 1949, 12 percent more than in 1948; but owing to a lower unit price the value increased only 10 percent. Nevertheless, all-time peaks in total value as well as quantity were established in 1949. Several additional properties were operated in 1949, mostly small producers, and the largest proportion of the output, as heretofore, came from one mine in the Matanuska Valley field and three mines in the Nenana field.

Gem Stones.—No jade (nephrite) was reported produced in the Kobuk area in 1949.

Limestone.—The Permanente Cement Co. shipped limestone during 1949 from its quarry on Dall Island in the Ketchikan district, Southeastern Alaska, to Washington State for the manufacture of cement.

Mercury.—Underground activity at the Decoursey Mountain mine, 24 miles from Crooked Creek, was stopped in August 1948, but placer operations there yielded 100 flasks of mercury in 1949.

Platinum Metals.—Placer deposits in the Goodnews Bay district, Kuskokwim region, continued to yield a substantial quantity of crude platinum metal; the output in 1949 was higher than in 1948. The

Goodnews Bay Mining Co. operated its Yuba electrically powered bucket-line dredge (with ninety-three 8-cubic-foot buckets) on the Salmon River for the recovery of crude platinum metals during the period from April 30 to November 15.

Sand and Gravel.—Production of sand and gravel in Alaska was reported by R. J. Sommers Construction Co., Juneau; Anchorage Sand & Gravel Co., Inc., Anchorage; the Alaska Road Commission; Bureau of Public Roads; Naval Operating Base, Kodiak; and the Corps of Engineers, Department of the Army.

Tin.—Output of tin in Alaska in 1949 was small—produced under difficulties in an isolated area—but was substantially above the 1948 level. The Northern Tin Co., Inc., shipped 47 short tons of placer-tin concentrate, containing 33 tons of tin, recovered from 39,000 cubic yards of gravel mined on Buck Creek; and the U. S. Tin Corp. produced 43 tons of concentrate (not sold), containing 23 tons of tin and a substantial quantity of tungsten, which was recovered from approximately 15,000 cubic yards of placer material mined from its Lost River property. Both operations are in the Port Clarence district, Seward Peninsula region. The Cleary Hill Mines Co. reported the recovery of a small quantity of tin concentrate as a byproduct of its placer-gold operation near Tofty in the Hot Springs district, Yukon River Basin region.

Tungsten.—The J. H. Scott Co., operating the Riverside mine near Hyder, Southeastern Alaska, produced a small quantity of tungsten concentrate from ore mined chiefly for its lead content in 1949; none of the material was shipped.

Miscellaneous Minerals.—Data on production of stone are not available for publication. There was no recorded production of asbestos, chromite, or petroleum in Alaska in 1949.

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Arizona
Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. Needham and Paul Luff

GENERAL SUMMARY

COPPER—the principal metal mined in Arizona—decreased from 375,121 short tons in 1948 to 359,010 tons in 1949, a 4-percent loss. However, the State made a record production of both lead and zinc in 1949, and production of silver was the greatest since 1943; the yield of gold declined slightly. Lead increased from 29,899 short tons in 1948 to 33,568 in 1949, a 12-percent gain; zinc from 54,478 short tons to 70,658, a 30-percent gain; and silver from 4,837,740 fine ounces to 4,970,736, a 3-percent gain; gold declined slightly from 109,487 fine ounces to 108,993. The State remained the largest producer of copper in the United States, ranked second in zinc, and was fourth in lead and silver; it again ranked first in total value of the five metals.

The total value of the five metals was $177,894,134 in 1949, compared with $196,207,948 in 1948, a 9-percent loss. The total value of the gold was $3,814,755—2 percent of the State total value; silver, $4,498,767—3 percent; copper, $141,449,940—79 percent; lead, $10,607,488—6 percent; and zinc, $17,523,184—10 percent. The value of the metals recovered from copper ore was $143,441,196 in 1949 ($166,494,997 in 1948) or 81 percent of the State total. About 89 percent of the State gold production and 75 percent of the silver in 1949 came from six districts—Ajo, Big Bug, Copper Mountain (Morenci), Pioneer (Superior), Verde (Jerome), and Warren (Bisbee); 99 percent of the copper came from eight districts—Ajo, Copper Mountain (Morenci), Eureka (Bagdad), Globe-Miami, Mineral Creek (Ray), Pioneer (Superior), Verde (Jerome), and Warren (Bisbee); 92 percent of the lead came from six districts—Aravaipa, Big Bug, Harshaw, Old Hat, Pima, and Warren (Bisbee); and 96 percent of the zinc came from eight districts—Big Bug, Cochise (Dragoon), Eureka (Bagdad), Harshaw, Old Hat, Pima, Verde (Jerome), and Warren (Bisbee).

Outstanding features of Arizona's mining activities in 1949 were suspension in June of copper mining at the Copper Queen mine of the Phelps Dodge Corp. at Bisbee and curtailment of operations at other large copper-producing mines, resulting from a sharp drop in copper demand followed by continuous declines in the price of copper during the second quarter of the year; the record output of zinc-lead ore from mines in the Aravaipa, Big Bug, Pima, Old Hat, and Warren (Bisbee) districts; the notable production of zinc in the Verde (Jerome) district; the sinking of two shafts by the Magma Copper Co. for underground development of the large copper ore body at the San Manuel property in the Old Hat district; the development of

two large copper ore bodies in the Globe-Miami district by the Miami Copper Co.; and the beginning of the construction of a new copper smelter at Ajo by the Phelps Dodge Corp.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold[1] (per fine ounce)	Silver[2] (per fine ounce)	Copper[3] (per pound)	Lead[3] (per pound)	Zinc[3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111: July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers: Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1945–49, and total, 1860–1949, in terms of recoverable metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	202	18	31,266,904	77,223	$2,702,805	3,558,216	$2,530,287
1946	194	33	31,058,179	79,024	2,765,840	3,268,765	2,641,162
1947	315	30	38,636,280	95,860	3,355,100	4,569,084	4,135,021
1948	360	39	39,925,686	109,487	3,832,045	4,837,740	4,378,399
1949	340	32	38,372,879	108,993	3,814,755	4,970,736	4,498,767
1860–1949			(1)	11,182,499	278,882,620	307,064,974	230,276,886

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	287,203	$77,544,816	22,867	$3,933,124	[2] 40,226	$9,251,980	$95,963,006
1946	289,223	93,706,252	23,930	5,216,740	43,665	10,654,260	114,986,254
1947	366,218	153,811,560	28,566	8,227,008	54,644	13,223,848	182,752,537
1948	375,121	162,802,514	29,899	10,703,842	54,478	14,491,148	196,207,948
1949	359,010	141,449,940	33,568	10,607,488	70,658	17,523,184	177,894,134
1860–1949	12,278,441	3,767,340,816	466,090	77,899,470	457,250	98,612,101	4,453,011,898

[1] Figure not available. [2] Corrected figure.

The average price of copper, lead, and zinc declined in 1949—copper to 19.7 cents a pound, lead to 15.8 cents a pound, and zinc to 12.4 cents a pound. The price of gold remained at $35 a fine ounce and silver at $0.905+ a fine ounce. At the beginning of the year the price of copper was 23.5 cents a pound, lead 21.5 cents a pound, and zinc 17.5 cents a pound. After continuous declines during the second quarter of the year, the price of copper reached a low of 16.0 cents

a pound June 17, lead dropped to a low of 12 cents a pound May 26, and zinc dropped to a low of 9 cents a pound June 15. At the end of the year, the price of copper was 18.5 cents a pound, lead 12 cents a pound, and zinc 9.75 cents a pound.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	10,160	422,152	32,926	2,320	4,725
February	8,971	409,678	31,986	2,430	5,180
March	11,590	513,974	37,271	2,815	5,905
April	10,671	486,648	34,876	2,890	5,750
May	10,300	451,320	32,326	2,835	5,865
June	8,656	407,674	27,866	3,170	6,565
July	7,166	338,648	25,376	2,725	5,635
August	6,730	358,920	22,361	2,680	5,990
September	7,990	362,820	25,951	2,720	5,695
October	9,171	406,184	27,491	2,995	6,370
November	8,988	404,698	29,390	3,000	6,440
December	8,600	408,020	31,190	2,988	6,538
Total: 1949	108,993	4,970,736	359,010	33,568	70,658
1948	109,487	4,837,740	375,121	29,899	54,478

Gold produced at placer mines in Arizona, 1945–49, by classes of mines and methods of recovery

Class and method	Mines producing	Material treated (cubic yards)	Gold recovered: Fine ounces	Gold recovered: Value	Gold recovered: Average value per cubic yard
Surface placers:					
Gravel mechanically handled:					
Dragline dredges:					
1945					
1946	1	160,000	185	$6,475	$0.04
1947–49					
Nonfloating washing plants:[1]					
1945					
1946	2	6,000	116	4,060	.68
1947	2	2,700	34	1,190	.44
1948	3	97,800	637	22,295	.23
1949	3	76,800	426	14,910	.19
Small-scale hand methods:					
Wet and dry:					
1945	16	3,500	535	18,725	5.35
1946	26	2,000	81	2,835	1.42
1947	19	6,500	241	8,435	1.30
1948	25	2,960	185	6,475	2.19
1949	27	4,365	130	4,550	1.04
Underground placers:					
Drift:					
1945	2	80	5	175	2.19
1946	4	200	16	560	2.80
1947	9	200	39	1,365	6.83
1948	11	135	16	560	4.15
1949	2	320	9	315	.98
Grand total placers:					
1945	18	3,580	540	18,900	5.28
1946	33	168,200	398	13,930	.08
1947	30	9,400	314	10,990	1.17
1948	39	100,895	838	29,330	.29
1949	32	81,485	565	19,775	.24

[1] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge"

Gold.—Despite a substantial increase in the production of gold from zinc-lead ore and zinc-copper ore in Arizona in 1949, the State output of gold declined slightly from 1948 owing to a decrease in gold from copper ore and gold ore. In 1949, 72 percent of the State gold output was recovered from copper ore, 19 percent from zinc-lead ore, and most of the remainder from zinc-copper ore, gold ore, lead ore, and silver ore. Gold from copper ore decreased 5,656 ounces and that from gold ore 3,345 ounces, but that from zinc-lead ore increased 5,068 ounces and that from zinc-copper ore 3,410. Gold from placers decreased from 838 ounces to 565. The New Cornelia mine of the Phelps Dodge Corp. in Pima County continued to be the leading gold producer in Arizona; it was followed by the Iron King mine in Yavapai County, the Magma mine in Pinal County, the Copper Queen (Bisbee) branch of the Phelps Dodge Corp. in Cochise County, the United Verde branch of the Phelps Dodge Corp. in Yavapai County, and the

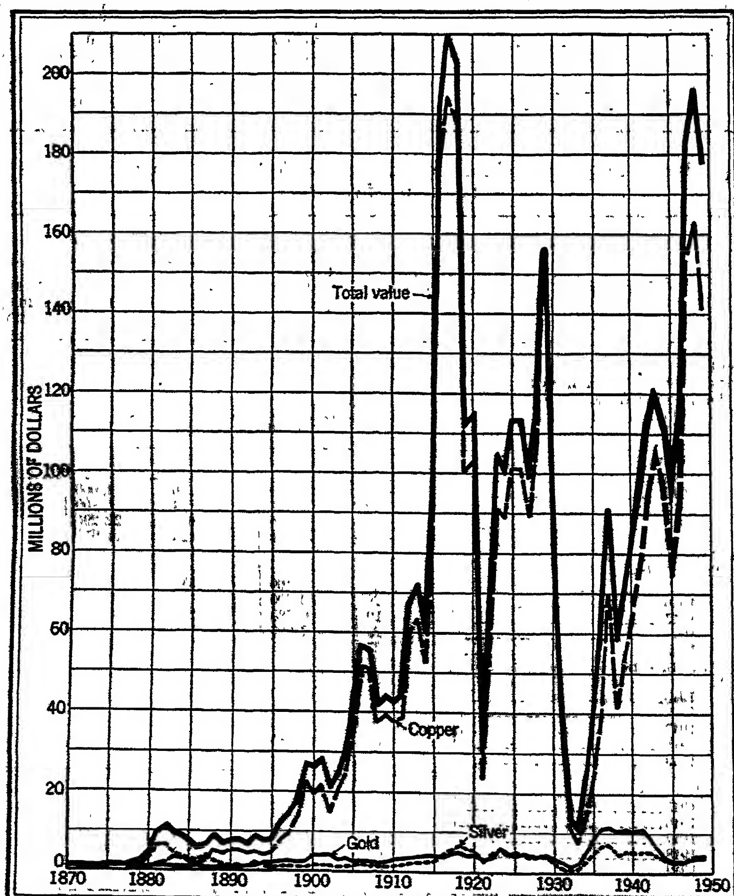

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in Arizona, 1870–1949. The value of lead and zinc has been less than $2,000,000 annually, except in a few years.

Morenci branch of the Phelps Dodge Corp. in Greenlee County; these six properties produced 88 percent of the State total gold.

Silver.—Most of the silver produced in Arizona is a byproduct of copper ore and zinc-lead ore, and in 1949 these two classes of ore yielded 4,332,989 ounces of silver (87 percent of the State total) compared with 4,358,986 ounces in 1948. A marked increase in production of silver from zinc-copper ore in 1949 prevented a decline in the State silver output. Copper ore yielded 2,412,359 ounces of silver (49 percent of the State total) and zinc-lead ore, 1,920,630 ounces (39 percent); the remainder came principally from silver ore, zinc-copper ore, lead ore, and zinc-lead-copper ore. Silver from copper ore decreased 402,474 ounces or 14 percent, but that from zinc-lead ore increased 376,477 ounces or 24 percent; that from zinc-copper ore, 132,278 ounces or 201 percent; and that from silver ore, 62,415 ounces or 25 percent. The Phelps Dodge Corp. continued to be the chief silver producer in Arizona, although its output was about 135,000 ounces (5 percent) less than that in 1948; its four properties (Copper Queen, Morenci, New Cornelia, and United Verde) produced 63 percent of the State gold output, 55 percent of the silver, and 63 percent of the copper; and its Copper Queen branch also produced 41 percent of the State's lead and 50 percent of the zinc. Other large silver producers in Arizona in 1949 were Iron King, Magma, San Xavier (Eagle-Picher Mining & Smelting Co.), Ash Peak, and Flux-January-Norton properties.

Copper.—Arizona's output of recoverable copper dropped to 718,020,000 pounds in 1949—32,222,000 pounds less than in 1948—owing to suspension in June of copper mining at the Copper Queen mine and to curtailment at other large copper producers. The Copper Moun-

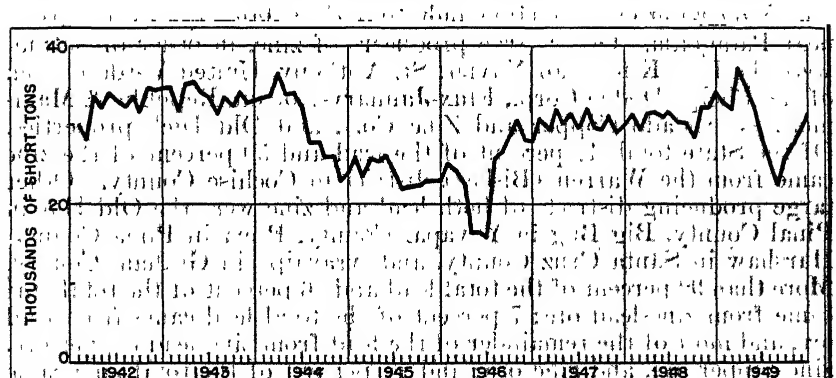

FIGURE 2.—Mine production of copper in Arizona, 1942–49, by months, in terms of recoverable metal.

tain (Morenci) district, with an output of 283,867,000 pounds of copper, remained the leading copper-producing area in the State; it was followed by the Globe-Miami district with 160,377,000 pounds, Ajo with 116,700,000, Pioneer (Superior) with 43,231,000, Mineral Creek

(Ray) with 37,190,600, Verde (Jerome) with 34,429,800, Warren (Bisbee) with 19,680,700, and Eureka (Bagdad) with 15,812,000. Substantial decreases in copper output in the Copper Mountain (Morenci), Globe-Miami, and Warren (Bisbee) districts more than offset increases in the Ajo, Eureka (Bagdad), Pioneer (Superior), and Verde (Jerome) districts. Copper ore and its products yielded 703,053,481 pounds of copper as follows: 33,528,676 tons of copper ore treated by concentration yielded 84 percent; 468,934 tons of copper ore shipped crude to smelters 5 percent; and 3,368,001 tons of copper ore leached and 14,608 tons of cement copper (from mine-water precipitates and underground leaching operations) 11 percent. The Morenci branch of the Phelps Dodge Corp. was again the largest copper producer in Arizona; it was followed in order by the New Cornelia branch of the Phelps Dodge Corp., Inspiration, Miami, Castle Dome, Magma, Ray (Kennecott Copper Corp.), United Verde branch of the Phelps Dodge Corp., Copper Queen branch of the Phelps Dodge Corp., and Bagdad properties. These 10 properties produced 99 percent of the State total copper.

Lead and Zinc.—In 1949 Arizona exceeded its 1948 record output of lead and its 1947 record output of zinc. The production of lead in 1949 (33,568 short tons) and the production of zinc (70,658 tons) were the largest for any year in the history of the State. Arizona mines have succeeded in setting a record lead output each year since 1944 and, except 1948, have made a record zinc output each year since 1940. The Copper Queen mine of the Phelps Dodge Corp. at Bisbee, with an increase of 23 percent in lead production and 28 percent in zinc production, remained by far the largest producer of lead and zinc in Arizona in 1949. Other large producers of lead, in order of output, were the St. Anthony property at Tiger, San Xavier mine near Sahuarita, Iron King mine at Humboldt, and Flux-January-Norton group near Patagonia. Other large producers of zinc, in order of output, were the Iron King, San Xavier, St. Anthony, United Verde branch of the Phelps Dodge Corp., Flux-January-Norton, Republic & Mammoth (Coronado Copper and Zinc Co.), and Old Dick properties. Of the State total, 41 percent of the lead and 50 percent of the zinc came from the Warren (Bisbee) district in Cochise County. Other large producing districts of both lead and zinc were the Old Hat in Pinal County, Big Bug in Yavapai County, Pima in Pima County, Harshaw in Santa Cruz County, and Aravaipa in Graham County. More than 92 percent of the total lead and 86 percent of the total zinc came from zinc-lead ore; 7 percent of the total lead came from lead ore, and most of the remainder of the lead from zinc-lead-copper ore, zinc-copper ore, and zinc ore; and 11 percent of the total zinc came from zinc-copper ore, and most of the remainder from zinc ore and zinc-lead-copper ore.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1949, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Cochise	37		12,854	$449,890	1,230,023	$1,113,233
Coconino	1		6	210	452	409
Gila	22	1	2,965	103,775	135,588	122,714
Graham	10		1,314	45,990	20,242	18,320
Greenlee	4		9,183	321,405	764,069	691,521
Maricopa	18	3	162	5,670	7,404	6,701
Mohave	25	1	525	18,375	16,977	15,365
Pima	31		38,586	1,350,510	730,146	660,819
Pinal	28	2	15,330	536,550	709,399	642,042
Santa Cruz	25		108	3,780	166,331	150,538
Yavapai	102	17	27,365	957,775	1,178,688	1,066,772
Yuma	37	8	595	20,825	11,417	10,333
Total: 1949	340	32	108,993	3,814,755	4,970,736	4,498,767
1948	360	39	109,487	3,832,045	4,837,740	4,378,399

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Cochise	21,126,700	$4,161,960	30,152,500	$4,764,095	75,851,500	$9,405,586	$19,894,764
Coconino	154,600	30,456					31,075
Gila	162,033,200	31,920,540	188,000	29,704			32,176,733
Graham	123,400	24,310	2,541,000	401,478	1,565,000	194,060	684,158
Greenlee	283,867,000	55,921,799	1,300	205			56,934,930
Maricopa	18,600	3,664	20,200	3,192	500	62	19,289
Mohave	249,700	49,191	333,500	52,693	860,500	106,702	242,326
Pima	117,700,400	23,186,979	8,496,500	1,342,447	14,386,500	1,783,926	28,324,681
Pinal	81,417,000	16,039,149	14,273,000	2,255,134	10,522,000	1,304,728	20,777,603
Santa Cruz	335,600	66,113	3,501,500	553,237	7,075,000	877,300	1,650,968
Yavapai	50,897,100	10,026,729	7,360,500	1,162,959	31,040,000	3,848,960	17,063,195
Yuma	96,700	19,050	268,000	42,344	15,000	1,860	94,412
Total: 1949	718,020,000	141,449,940	67,136,000	10,607,488	141,316,000	17,523,184	177,894,134
1948	750,242,000	162,802,514	59,798,000	10,703,842	108,956,000	14,491,148	196,207,948

MINING INDUSTRY

Despite a year of wide fluctuation in the market prices of copper, lead, and zinc, Arizona's mining industry in 1949 was good compared with that of other States. The output of copper ore decreased 4 percent from the record of 39,072,204 tons in 1948 to 37,365,611 tons in 1949, but the output of zinc-lead ore increased from a record of 664,603 tons to a new all-time record of 773,617 tons. Zinc-copper ore increased to 163,213 tons—a 61-percent gain—and zinc ore to 10,344 tons—a 161-percent gain; but siliceous ores declined to 38,967 tons—a 31-percent loss—and lead ore to 15,829 tons—a 32-percent loss. Of the State total ore, 37,321,394 tons (97 percent) were copper ore mined in the Copper Mountain (Morenci), Globe-Miami, Ajo, Mineral Creek (Ray), Eureka (Bagdad), Pioneer (Superior), Verde (Jerome), and Warren (Bisbee) districts, and 749,625 tons (97 percent) of the State total zinc-lead ore were mined in the Warren (Bisbee), Big Bug, Old Hat (Oracle), Pima, Harshaw, and Aravaipa districts. Mining operations at five open pits—Ajo, Bagdad, Inspiration, Miami (Castle

Dome), and Morenci—produced 29,082,243 tons of copper ore in 1949 compared with five open pits in 1948, which produced 29,638,873 tons. Development of open-pit mining at the Ray property of the Kennecott Copper Corp. has progressed to a point allowing production to begin early in 1950. Labor was more plentiful in 1949 than in 1948, although skilled miners continued scarce.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Arizona in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold ore	76	4,567	2,178	7,156	22,668	22,715	80,446
Dry gold-silver ore	9	687	199	6,898	1,683	6,580	2,158
Dry silver ore	29	33,713	704	314,241	40,403	8,279	----------
Total	114	38,967	3,081	328,295	64,754	37,574	82,604
Copper ore	88	37,365,611	78,735	2,412,359	[1] 703,053,481	3,974	----------
Lead ore	117	15,829	1,710	76,822	66,923	4,457,110	252,070
Lead-copper ore	3	45	----------	271	2,789	12,792	1,010
Zinc ore	8	10,344	127	11,076	96,643	89,019	2,152,656
Zinc-copper ore	7	163,213	4,336	198,089	8,663,807	143,602	16,085,522
Zinc-lead ore	40	773,617	20,429	1,920,630	5,901,596	62,113,354	121,621,724
Zinc-lead-copper ore	6	5,253	10	23,131	170,007	278,575	1,120,414
Total lode mines	[2] 340	38,372,879	108,428	4,970,673	718,020,000	67,136,000	141,316,000
Placers	32	----------	565	63	----------	----------	----------
Total: 1949	372	38,372,879	108,993	4,970,736	718,020,000	67,136,000	141,316,000
1948	399	39,925,686	109,487	[3] 4,837,740	[4] 750,242,000	59,798,000	108,956,000

[1] Includes 76,951,738 pounds recovered from ore leached and mine-water precipitates.
[2] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[3] Includes 80 ounces recovered from underground mine-water precipitates.
[4] Includes 86,709,683 pounds recovered from ore leached and mine-water precipitates.

METALLURGIC INDUSTRY

Of the 38,372,879 tons of ore produced in 1949 in Arizona, 34,482,033 tons (90 percent) were treated at 33 milling plants and 3,368,001 tons (9 percent) at 1 copper leaching plant; the remainder—522,845 tons (1 percent)— was shipped crude to smelters.

Ore treated at milling plants in 1949 comprised chiefly 33,528,676 tons of copper ore, 771,296 tons of zinc-lead ore, and 163,119 tons of zinc-copper ore. Copper ore from the Miami property was treated by a combination of leaching and concentration, and copper ore from the Inspiration mine was treated by straight leaching and by leaching and concentration. The large copper-concentration plants at Morenci (45,000-ton a day), Ajo (25,000-ton), Miami (18,000-ton), Inspiration (18,000-ton), Castle Dome (10,000-ton), Hayden (10,000-ton), Bagdad (3,000-ton), Clarkdale (2,100-ton), and Superior (1,500-ton); the copper-leaching plants at Inspiration (9,000-ton), and Miami

(3,000-ton); and the zinc-lead concentration mills at Bisbee (Copper Queen 900-ton), Sahuarita (Eagle-Picher 500-ton), Humboldt (Iron King 670-ton), Tiger (St. Anthony 500-ton), and Patagonia (Trench 200-ton) were operated continuously in 1949, most of them at a higher rate than in 1948. The copper smelters of the Phelps Dodge Corp. at Clarkdale, Douglas, and Morenci, the International Smelting & Refining Co. copper smelter at Miami, the American Smelting & Refining Co. copper smelter at Hayden, and the Magma Copper Co. copper smelter at Superior operated continuously throughout the year. Most of the copper concentrates produced at mills in Arizona are treated at smelters in Arizona, but nearly all the lead concentrates produced at mills in Arizona in 1949 were shipped to the smelter at El Paso, Tex., and all the zinc concentrates were shipped to smelters at Amarillo and Dumas, Tex.; Fort Smith, Ark.; Henryetta, Okla.; and Anaconda and Great Falls, Mont.

The following tables give details of the treatment of ores produced in Arizona in 1949.

Mine production of metals in Arizona in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	40	16			
Concentrates smelted	88,257	3,904,455	602,196,907	62,507,186	140,666,862
Ore smelted	20,131	1,066,202	38,871,355	4,628,814	649,138
Copper precipitates smelted			[1] 19,923,626		
Copper ore leached			[2] 57,028,112		
Placer	565	63			
Total: 1949	108,993	4,970,736	718,020,000	67,136,000	141,316,000
1948	109,487	4,837,740	750,242,000	59,798,000	108,956,000

[1] Distributed as follows: Cochise County, 353,700 pounds; Gila County, 7,494,800 pounds; Greenlee County, 6,511,600 pounds; Pinal County, 5,305,909 pounds; and Yavapai County, 257,617 pounds.
[2] Treated by straight leaching at 1 plant in Gila County.

Gross metal content of Arizona ore treated at mills in 1949, by classes of ore [1]

Class of ore	Ore (short tons)	Gross metal content of mill feed				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	585	212	643	8,100	200	600
Copper	33,528,676	82,889	2,209,333	703,488,029		5,318,000
Lead	2,876	121	7,851	3,522	540,796	88,950
Zinc	10,238	24	13,813	135,160	117,876	2,702,374
Zinc-copper	163,119	6,583	280,166	10,247,855	319,432	25,994,603
Zinc-lead	771,296	30,829	2,360,692	8,300,769	71,449,180	146,315,475
Zinc-lead-copper	5,243	13	26,027	238,232	305,166	1,309,885
Total: 1949	34,482,033	120,671	4,898,525	722,421,667	72,732,650	181,729,887
1948	35,412,392	102,804	4,122,731	714,828,125	62,677,804	151,457,959

[1] Exclusive of copper ore by leaching.

Gross metal content of concentrates produced from ores mined in Arizona in 1949, by classes of concentrates smelted

Class of concentrates	Concentrates (short tons)	Gross metal content: Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	7	24	84	50	131	300
Copper	1,144,348	68,223	1,986,756	611,578,914	40,969	6,761,526
Lead	65,027	14,649	1,385,792	4,390,705	57,124,599	12,827,894
Lead-copper	265	8	24,574	114,013	292,867	73,311
Zinc	131,130	4,593	595,333	3,442,572	7,815,603	138,549,190
Zinc-copper	499	13	1,314	133,522	14,151	196,657
Zinc-lead	106	11	3,676	2,362	79,176	34,226
Zinc-lead-copper	158	28	6,311	85,080	107,765	164,622
Iron	15,018	2,515	40,230	21,042	344,628	1,939,376
Total: 1949	1,356,558	90,064	4,044,070	619,768,260	65,819,889	160,547,102
1948	1,502,513	79,522	3,435,562	617,732,751	57,019,687	131,973,570

Mine production of metals from mills in Arizona in 1949, by counties and by classes of concentrates smelted, in terms of recoverable metals

	Material treated (short tons)	Recoverable in bullion: Gold (fine ounces)	Recoverable in bullion: Silver (fine ounces)	Concentrates smelted and recoverable metal: Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Cochise	329,780			98,692	2,970	787,998	5,049,082	28,211,260	75,771,300
Gila	7,828,813			144,669	2,505	125,481	95,581,430		
Graham	18,948			2,190	488	9,509	47,080	1,380,000	1,253,550
Greenlee	14,488,723			536,603	8,373	608,000	275,866,857		
Maricopa	10	2	1	1	2	2			
Mohave	9,737	2	1	1,685	146	11,772	223,059	216,635	830,476
Pima	8,209,058	34	13	234,260	38,455	717,984	117,396,975	8,463,145	14,383,100
Pinal	2,037,285			155,751	13,811	516,277	71,650,567	13,617,216	10,404,190
Santa Cruz	53,611			8,521	95	161,395	314,924	3,392,620	7,050,312
Yavapai	1,564,478	2	1	173,083	21,412	970,722	36,066,933	7,137,119	30,958,934
Yuma	2,100			163		3,315		89,191	15,000
Total: 1949	34,482,653	40	16	1,356,558	88,257	3,904,455	602,196,907	62,507,186	140,666,862
1948	35,412,392	46	22	1,502,513	78,047	3,314,406	602,299,717	53,994,566	108,771,346
BY CLASSES OF CONCENTRATES									
Gold				7	24	84	35	124	
Copper				1,144,348	67,293	1,920,271	595,288,232	25,860	87,200
Lead				65,027	14,649	1,385,792	3,738,706	55,094,654	10,164,351
Lead-copper				265	8	24,574	96,937	283,950	57,219
Zinc				131,130	3,717	522,311	2,857,278	6,582,393	128,524,984
Zinc-copper				499	12	1,206	122,863	8,866	166,107
Zinc-lead				106	11	3,676	2,007	76,913	26,229
Zinc-lead copper				158	28	6,311	72,975	103,605	128,800
Iron				15,018	2,515	40,230	17,874	330,821	1,511,972
Total 1949				1,356,558	88,257	3,904,455	602,196,907	62,507,186	140,666,862

Gross metal content of Arizona crude ore shipped to smelters in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	3,982	2,015	6,785	18,595	24,110	107,768
Dry gold-silver	687	199	6,898	1,836	9,634	19,575
Dry silver	33,713	704	314,241	44,261	14,390	2,608
Copper	468,934	15,120	660,897	41,082,098	6,638	6,141,500
Lead	12,953	1,626	69,805	79,061	4,167,588	283,664
Lead-copper	45		271	3,281	13,325	2,000
Zinc	106	117	608	1,448	2,774	22,861
Zinc-copper	94		121	8,688	673	11,280
Zinc-lead	2,321	350	6,568	47,204	598,940	426,442
Zinc-lead-copper	10		8	702	1,542	2,088
Total: 1949	522,845	20,131	1,066,202	41,287,174	4,839,614	7,019,786
1948	760,097	30,556	1,523,096	64,388,096	6,072,631	8,383,285

Mine production of metals from Arizona crude ore shipped to smelters in 1949, in terms of recoverable metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Cochise	145,531	9,884	442,025	15,723,918	1,941,220	80,200
Coconino	1,257	6	452	154,600		
Gila	45,101	458	10,107	1,928,858	188,000	
Graham	4,889	826	10,733	76,320	1,161,000	311,450
Greenlee	84,736	810	164,069	1,488,543	1,300	
Maricopa	321	152	7,401	18,600	20,200	500
Mohave	847	376	5,204	26,641	116,865	30,024
Pima	3,436	97	12,149	303,425	33,355	3,400
Pinal	58,849	1,517	193,122	4,460,524	655,784	117,810
Santa Cruz	676	13	4,936	20,676	108,880	24,688
Yavapai	174,648	5,508	207,913	14,572,550	223,401	81,066
Yuma	2,554	484	8,091	96,700	178,809	
Total: 1949	522,845	20,131	1,066,202	38,871,355	4,628,814	649,138
1948	760,097	30,556	1,523,096	61,232,600	5,803,434	184,654
BY CLASSES OF ORE						
Dry gold	3,982	2,015	6,785	17,428	22,591	80,446
Dry gold-silver	687	199	6,898	1,683	6,580	2,158
Dry silver	33,713	704	314,241	40,403	8,279	
Copper	468,934	15,120	660,897	38,694,396	3,974	
Lead	12,953	1,626	69,805	64,431	3,992,300	197,994
Lead-copper	45		271	2,789	12,792	1,010
Zinc	106	117	608	1,244	2,727	16,500
Zinc-copper	94		121	8,340	379	9,024
Zinc-lead	2,321	350	6,568	40,044	577,742	340,367
Zinc-lead-copper	10		8	597	1,450	1,639
Total 1949	522,845	20,131	1,066,202	38,871,355	4,628,814	649,138

REVIEW BY COUNTIES AND DISTRICTS

COCHISE COUNTY

California District.—In 1949 eight mines in the California district produced 586 tons of ore containing 545 ounces of silver, 2,301 pounds of copper, 107,013 pounds of lead, and 67,409 pounds of zinc. The principal output was 459 tons of zinc-lead ore, shipped from the King-Ainsworth and Pine-Zinc properties to the Shattuck Denn custom flotation mill at Bisbee, Ariz., and 96 tons of lead ore produced from the Leadville group near Portal.

Cochise District.—Output in 1949 was nearly all zinc-copper ore from the Republic and Mammoth mines of the Coronado Copper & Zinc Co. near Dragoon; however, operations ceased June 30. The company reported that 37,558 tons of ore were treated in its 150-ton flotation mill, which yielded 2,264 tons of copper concentrate and 3,565 tons of zinc concentrate.

Dos Cabezas and Tevis District.—W. R. Shanklin worked the Gold Prince mine all year and shipped 761 tons of gold ore to the smelter at El Paso, Tex. The rest of the district output was 80 tons of zinc-lead ore produced from the LeRoy Consolidated Mines and a small lot of high-grade gold ore from the Double Eagle claim.

Golden Rule District.—Output in 1949 was 87 tons of lead ore produced from the Golden Rule mine near Dragoon and 35 tons of zinc ore from the Hubbard mine.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1949 by counties and districts, in terms of recoverable metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Cochise County:													
California	8		586				516		516	1,700	92,500	50,000	$21,617
Cochise	2		37,566				11,079		11,079	1,377,200		3,519,900	717,803
Dos Cabezas and Tevis	3		841	434		434	790		790	700	6,300	13,200	18,675
Golden Rule	2		122	50		50	222		222	400	10,000	10,200	4,875
Hartford	3		67	1		1	252		252		12,100		2,175
Smelter	1		1,238	237		237	7,519		7,519	6,800	385,000		77,270
Swisshelm	2		5,878	274		274	33,608		33,608	10,200	1,745,000	106,800	330,969
Tombstone	8		1,047	10		10	2,170		2,170	2,700	86,200	64,500	24,464
Turquoise	5		8,798	11		11	7,625		7,625	46,000	84,700	1,301,800	191,154
Warren (Bisbee)	2		419,160	11,837		11,837	1,166,210		1,166,210	19,680,700	27,730,300	70,785,100	18,505,611
Winchester	1		8				32		32	300	400		151
Coconino County: Jacob Canyon	1		1,257	6		6	452		452	154,600			31,075
Gila County:													
Banner	5		32,048	240		240	7,720		7,720	1,646,000	63,500		349,682
Dripping Springs [1]	1		253	217		217	252		252	2,000	61,500		17,934
Globe-Miami	11		11,209,489	2,505		2,505	126,826		126,826	160,377,000	61,600		31,806,461
Pioneer [2]	3	1	74	1	2	3	758		758	1,600	1,400		1,327
Summit	2		51				32		32	6,600			1,329
Graham County:													
Aravaipa	7		23,188	1,310		1,310	20,127		20,127	118,600	2,541,000	1,565,000	682,968
Black Rock	1		2							100			20
Stanley	2		47	4		4	115		115	4,700			1,170
Greenlee County:													
Ash Peak	1		17,624	644		644	157,958		157,958				165,500
Copper Mountain (Morenci)	3		14,555,835	8,539		8,539	606,111		606,111	283,867,000	1,300		56,769,430
Maricopa County:													
Big Horn	1		21				63		63		7,500	500	1,304
Cave Creek and Camp Creek	4		75	9		9	6,362		6,362	16,600			9,343
Gila Bend Mountains	1		3	1		1							35
Osborn	1		11							1,700			335
Pikes Peak	2		14	27		27	10		10				954
San Domingo		3			6	6							210
Sunflower	1		80	12		12	938		938	100	12,500		3,264
Vulture	5		106	96		96	21		21	200	100		3,434
White Picacho [3]	1		1								100		16
Winifred	2		20	11		11	10		10				394
Mohave County:													
Bentley	1		9				11		11	3,700			739
Cedar Valley	2		5,059	14		14	2,317		2,317	220,600	30,500	577,900	122,524
Chemehuevis	1		2	2		2	10		10		200		111
Copper Mountain	1		195	163		163	1,728		1,728	12,200	6,100	16,500	12,682
Cottonwood	1		3	3		3							105

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1949 by counties and districts, in terms of recoverable metals—Continued

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Mohave County—Continued													
Gold Basin		1			1	1							$35
Owens	6		383	16		16	1,653		1,653	400	80,900	4,000	15,413
San Francisco	2		21	38		38	31		31		4,800		2,116
Wallapai	9		4,803	243		243	10,827		10,827	11,400	211,000	262,100	86,388
Weaver	2		109	45		45	400		400	1,400			2,213
Pima County:													
Ajo	1		8,126,032	38,455		38,455	471,134		471,134	116,700,000			24,762,225
Amole	1		40				22		22		3,500		573
Arivaca	5		85	2		2	748		748	300	4,300	200	1,510
Baboquivari	1		3				11		11	100			30
Cababi	4		67	89		89	263		263	100			3,373
Cerro Colorado	1		93				2,538		2,538	400	1,800		2,660
Growler	1		2							200			39
Helvetia (Rosemont)	4		3,170				2,464		2,464	266,700	18,200	30,300	61,403
Old Hat [4]	1		84	4		4	326		326	25,000			5,360
Pima (Sierritas, Papago, Twin Buttes)	8		82,785	35		35	252,334		252,334	695,000	8,464,000	14,353,500	3,483,661
Quijotoa	1		2	1		1							35
Silver Bell	3		181				306		306	12,600	4,700	2,500	3,812
Pinal County:													
Casa Grande	1		13,621	13		13	123,908		123,908	4,900	1,200		113,753
Dripping Springs [1]	2		555	1		1	4,814		4,814	25,900	5,800		10,410
Martinez Canyon	1		9				105		105	100	1,300		320
Mineral Creek (Ray)	5		1,557,387	423		423	34,514		34,514	37,190,600	634,500	116,000	7,487,225
Mineral Hill	8		769	275		275	1,643		1,643	5,800	54,500	16,800	22,949
Old Hat [4]	8	2	142,918	1,765	2	1,767	143,202		143,202	958,400	13,575,000	10,389,200	3,813,366
Picacho	1		2							300			59
Pioneer [3] (Superior)	1		380,917	12,839		12,839	401,202		401,202	43,231,000			9,328,980
Sleeping Beauty	1		6	12		12	11		11		700		541
Santa Cruz County:													
Harshaw	8		48,139	87		87	140,011		140,011	152,600	3,091,100	5,894,200	1,379,099
Oro Blanco	3		313	8		8	1,496		1,496	700	33,300	34,800	11,348
Pajarito	1		1								1,200		190
Patagonia (Duquesne)	6		5,241	3		3	23,076		23,076	171,000	300,000	1,109,400	239,643
Tyndall	6		541	10		10	1,738		1,738	11,300	75,000	36,600	20,537
Wrightson	1		2				10		10		900		151
Yavapai County:													
Agua Fria	2		527	14		14	231		231	35,300			7,653
Big Bug	11	3	177,119	13,981	54	14,035	581,351		581,351	364,900	6,659,500	17,595,600	4,323,317
Black Canyon	6	1	464	179	1	180	1,369		1,369	5,400	2,700	100	9,042
Black Hills	1		113				252		252	5,200	5,500		2,121
Black Rock	7		75	41		41	159		159	6,300	3,700		3,405

Blue Tank	1	2	97	4	3	7	11		11	8,400			1,910
Bloody Basin	1		5				10		10	300			68
Castle Creek	2	1	5	2	1	3	10		10	100			134
Copper Basin	5		3,922	30		30	389		389	192,600	15,600	17,900	44,029
Drake		1			1	1							35
Eureka (Bagdad)	16		1,083,538	1,162		1,162	72,544		72,544	15,812,000	375,200	4,607,200	3,851,865
Hassayampa	12	2	667	166	2	168	3,801		3,801	4,600	138,500	29,500	35,767
Humbug	1		2	2		2	53		53				118
Kirkland	1		5	2		2							70
Lynx Creek		1			365	365		52	52				12,822
Martinez	1		62	36		36	63		63				1,317
Minnehaha	1		19	2		2	1,758		1,758				1,661
Pine Grove	3		397	232		232	1,633		1,633	3,400	4,800		11,026
Silver Mountain		1			1	1							35
Tiger	6		774	110		110	3,013		3,013	7,400	19,800	23,800	14,114
Tip Top	1		163	11		11	180		180	19,100			4,311
Turkey Creek	4		6	3		3	285		285	100	300		430
Verde (Jerome)	2		410,607	10,790		10,790	509,828		509,828	34,429,800	71,600	8,700,000	8,711,854
Walker	7	2	499	125	3	128	1,359		1,359	1,600	57,400	65,900	23,266
Walnut Grove	6		38	6		6	242		242	200	3,400		1,005
Weaver	1	3	12	24	12	36	11		11				1,270
White Picacho [3]	4		10				84		84	400	2,500		550
Yuma County:													
Castle Dome	9		482	3		3	1,328		1,328		73,900	800	13,082
Cienega	8		1,829	425		425	242		242	88,000			32,430
Dome (Gila City)		1			5	5							175
Ellsworth (Harqua Hala)	6		102	12		12	94		94	7,000	1,100		2,058
Eureka (Silver Camp)	3		1,747				2,697		2,697		47,500	14,200	11,707
Kofa Mountains and Tank Mountains	2		3	27		27	20		20				963
LaPaz		1			2	2							70
Middle Camp		1			2	2							70
Plomosa	8	3	580	16	59	75	7,004	11	7,015	1,400	145,500		32,239
Trigo		2			43	43							1,505
Weaver	1		1	1		1	21		21	300			113
Total 1949	340	32	38,372,879	108,428	565	108,993	4,970,673	63	4,970,736	718,020,000	67,136,000	141,316,000	177,894,134

[1] Dripping Springs district lies in both Gila and Pinal Counties.
[2] Pioneer district lies in both Gila and Pinal Counties.
[3] White Picacho district lies in both Maricopa and Yavapai Counties.
[4] Old Hat district lies in both Pima and Pinal Counties.

Hartford (Huachuca Mountains) District.—Lead ore (67 tons) was produced in 1949 from the Armistice, Anne Marie, and Borderland Metals properties near Hereford.

Smelter District.—Virtually all output was lead residues (1,238 tons) shipped from the Phelps Dodge Corp. copper smelter at Douglas, Ariz.

Swisshelm (Elfrida) District.—In 1949 two mines—the Chance and Scribner—in the Swisshelm district produced 5,878 tons of lead ore containing 298 ounces of gold, 34,073 ounces of silver, 12,721 pounds of copper, 1,848,870 pounds of lead, and 156,250 pounds of zinc. The Scribner mine, operated all year by Edwin Larson, was by far the most important producer.

Tombstone District.—Output in 1949 comprised 900 tons of zinc-lead ore, 116 tons of lead ore, 27 tons of gold-silver ore, and 4 tons of silver ore, which contained 11 ounces of gold, 2,286 ounces of silver, 4,871 pounds of copper, 97,738 pounds of lead, and 78,399 pounds of zinc. All the zinc-lead ore was produced from the Mary Jo mine by the Charleston Lead Mines Co.; the lead ore came largely from the Tombstone Extension and Bald Eagle properties and all the gold-silver ore from the Tombstone group.

Turquoise (Courtland, Pearce, Gleeson) District.—In 1949 five mines in the Turquoise district produced 8,798 tons of ore containing 21 ounces of gold, 10,357 ounces of silver, 64,478 pounds of copper, 108,783 pounds of lead, and 1,703,371 pounds of zinc. The principal output was zinc ore (8,161 tons) from the San Juan group, operated by the Billingsley Machinery Co., and the Abril group, operated by the Shattuck Denn Mining Corp.; however, both properties closed down in May owing to the drop in the price of zinc. Zinc-lead ore (472 tons) was produced from the Last Chance claim, copper ore (164 tons) from the Shannon group, and lead ore (1 ton) from the Sycamore claim.

Warren (Bisbee) District.—The Warren district continued to be the largest producer of silver, lead, and zinc in Arizona and in 1949 ranked fourth in gold and seventh in copper. The gold output declined 38 percent from 1945, silver 19 percent, and copper 49 percent, but the lead output increased 23 percent and zinc 28 percent. The value of the metal output of the district decreased from $21,686,724 in 1948 to $18,505,611 in 1949, owing to lower base-metal prices and a marked drop in copper output. The large decrease in copper output resulted from the closing June 5 of copper operations at the Copper Queen mine of the Phelps Dodge Corp., caused from continued declines in the price of copper during the second quarter of the year. The corporation reported that the Copper Queen branch produced 138,413 tons of copper ore and 280,742 tons of zinc-lead ore in 1949 compared with 302,941 and 218,466 tons, respectively, in 1948. In addition, 429 tons of copper precipitates were produced. The zinc-lead ore was treated in the corporation 900-ton flotation mill at Bisbee; and the copper ore, along with the copper precipitates, was shipped direct to the corporation smelter at Douglas.

According to the corporation annual report for 1949, mining of copper ore at the Copper Queen mine was suspended in June owing to the unfavorable market situation during the second quarter of the year. Copper produced in 1949 totaled 21,864,907 net pounds compared with 36,587,178 net pounds in 1948; lead produced totaled

20,718,742 net pounds compared with 17,550,887 net pounds; and zinc produced totaled 56,685,269 net pounds compared with 46,868,961 net pounds. The zinc-lead ore reserves minable at present prices will be substantially exhausted in 1950, and it is planned to discontinue zinc-lead mining around the middle of the year. When zinc-lead operations cease, it is expected that, if economic conditions warrant, the mining of copper ore will be resumed.

The Shattuck Denn Mining Corp. 150-ton flotation mill at Bisbee operated entirely on custom ores until October 31, when it was shut down resulting from lack of a sufficient supply of custom ores. As a result of the sale of the Denn mine in 1947, and the closing of its custom mill in 1949, the corporation is now conducting no active business in the Bisbee district after approximately 45 years of activity.

COCONINO COUNTY

Lessees continued operations at the open pit of the Petoskey mine in the Jacob Canyon (Warm Springs) district and shipped 1,257 tons of carbonate copper ore containing 6 ounces of gold, 452 ounces of silver, and 159,392 pounds of copper.

GILA COUNTY

Banner (Christmas and Tornado) District.—The principal output of the Banner district continued to be high-lime fluxing ore (31,741 tons in 1949), containing an average of 2.645 percent copper. The ore was shipped from the Christmas mine by the Sam Knight Mining Lease, Inc., to the copper smelter at Hayden, Ariz., where it is needed for fluxing purposes. Other district production included 267 tons of lead ore and copper ore shipped from the Kullman-McCool and London-Arizona properties near Winkelman.

Dripping Springs District.—Harry Storm worked the C–B claim and shipped 253 tons of lead ore to the smelter at El Paso, Tex.

Globe-Miami District.—The Globe-Miami district, with a production of 160,377,000 net pounds of copper in 1949 (176,956,200 net pounds in 1948), continued to rank second among the important copper-producing areas in Arizona; the Copper Mountain (Morenci) district in Greenlee County remained in first place. The Inspiration property, with a yield of 62,805,750 net pounds of copper (76,705,570 net pounds in 1948), remained the leading copper producer in the district and ranked third in the State. The Inspiration Consolidated Copper Co. reported that 3,619,906 tons of copper ore were treated in 1949 compared with 3,978,373 tons in 1948. Of the total ore, 3,368,001 tons, averaging 0.978 percent copper—0.563 percent copper as oxide and 0.415 percent as sulfide—from which the slimes had been removed, were treated by acid ferric sulfate in the main leaching plant. Slimes (239,753 tons averaging 1.421 percent copper) removed from ore at the main leaching plant were treated in the company flotation concentrator for extraction of the sulfide copper content, and the tailings from the operation were leached by sulfuric acid solution for extraction of the oxide copper content. In addition, 12,752 tons of crude copper ore and 86 tons of copper precipitates were sent direct to the smelter at Miami, Ariz. The total copper production per ton of ore treated in 1949 was 17.674 pounds.

According to the report of the Inspiration company for 1949, operations proceeded at a curtailed rate from May into November owing to a decline in the demand for copper. Ore production was from both underground and open-pit operations—2,016,086 tons of ore averaging 0.960 percent copper were mined from underground and 1,597,384 tons averaging 1.063 percent copper from the open pit. All necessary work underground was completed during the year for leaching in place certain mined-out and caved areas in the mine to recover part of the remaining copper, and surface installations were virtually completed. Production of copper from this source will begin in 1950.

The Miami mine of the Miami Copper Co. and the Castle Dome Copper Co., Inc. (a wholly owned subsidiary of the Miami Copper Co.), ranked second and third, respectively, in copper production in the district. The Miami Copper Co. reported that 96,553,259 net pounds of copper were produced from the two properties in 1949 (50,247,202 net pounds from the Miami mine and 46,306,057 net pounds from the Castle Dome mine) compared with 99,004,662 net pounds in 1948.

According to the annual report of the Miami Copper Co. for 1949, copper was produced at the Miami mine by underground mining followed by flotation and by acid leaching of material overlying the mined-out areas. The 18,000-ton concentrator treated 3,844,138 tons of ore averaging 0.735 percent copper, and 78,972 tons of copper concentrate and 3,029 tons of copper precipitates were shipped to smelters in Arizona. In addition to copper, the concentrate contained 1,216 ounces of gold and 44,450 ounces of silver, and re-treatment of copper concentrate recovered 502,858 pounds of molybdenum. Ore reserves, as of January 1, 1950, were estimated to be 23,004,854 tons averaging 0.833 percent copper. The Castle Dome open pit and 10,000-ton concentrator were operated continuously throughout 1949 but at a reduced rate beginning in July. The mill treated 3,744,922 tons of ore averaging 0.706 percent copper, which yielded 64,402 tons of copper concentrate. In addition to copper, the concentrate contained 1,261 ounces of gold and 79,449 ounces of silver. A total of 4,094,258 tons of waste was removed in connection with the mining of Castle Dome ore and to complete the stripping preparatory to mining Red Hill ore. As of January 1, 1950, ore reserves were estimated to be 9,960,027 tons averaging 0.701 percent copper, including the Red Hill ore. In addition, a block of approximately 3,665,000 tons averaging 0.54 percent copper is known to lie between the 4,040- and 4,085-foot levels of the Castle Dome ore body. Exploration by churn drilling during the past several years at the property of the company's wholly owned subsidiary—Copper Cities Mining Co. in the Globe-Miami district—was completed in 1949. A copper deposit amenable to open-pit mining and comparable in size and grade to the Castle Dome ore body was outlined.

The rest of the district output was largely 401 tons of copper ore produced from the Carlota, Copper Hill, and Superior & Boston properties.

Pioneer District.—Output in 1949 was principally 48 tons of silver ore produced from the El Capitan mine, 13 tons of copper ore from

the Mariana claim, and 13 tons of lead ore from the Silver Creek claim.

Summit District.—Output in 1949 was all copper ore (51 tons) produced from the Red Hill and Richard claims near Miami.

GRAHAM COUNTY

Aravaipa District.—Zinc-lead ore from the Aravaipa group of the Athletic Mining Co. near Klondyke continued to be the main output in the Aravaipa district. The company reported that 18,348 tons of zinc-lead ore were treated in its 100-ton flotation mill in 1949 and that 2,177 tons of similar ore were shipped direct to a smelter at El Paso, Tex. The total ore contained 1,206 ounces of gold, 21,803 ounces of silver, 146,000 pounds of copper, 2,272,000 pounds of lead, and 2,483,400 pounds of zinc. The rest of the district output was principally 2,524 tons of lead ore produced from the Sein Fein mine.

GREENLEE COUNTY

Ash Peak District.—All output in 1949 was fluxing ore (17,624 tons), averaging 0.037 ounce of gold and 8.963 ounces of silver to the ton and 80 percent silica, shipped to the International copper smelter at Miami from the Ash Peak mine near Duncan by the Ash Peak Lease.

Copper Mountain (Morenci) District.—The Copper Mountain district, with a production of 283,867,000 net pounds of copper in 1949 (296,632,000 net pounds in 1948), remained the chief copper-producing area in Arizona, as the Morenci mine of the Phelps Dodge Corp. continued to be the outstanding producer of copper in the State. The corporation reported that 14,488,723 tons of copper ore from the Morenci mine were treated in the 45,000-ton concentrator in 1949 compared with 15,567,480 tons in 1948 and that 536,603 tons of copper concentrate, 66,871 tons of crude copper ore, and 4,468 tons of copper precipitates were shipped direct to the Morenci smelter. In addition to copper, the mine was an important producer of gold and silver, and in November an experimental unit was placed in operation in one part of the concentrator to treat a portion of the copper concentrate for recovery of the molybdenite.

According to the annual report of the Phelps Dodge Corp. for 1949, the sharp drop in copper demand during the second quarter of the year caused a reduction in the workweek from 6 to 5 days; however, with an improving demand for copper, the 6-day workweek was resumed at Morenci early in September. Copper ore mined totaled 14,555,594 tons, and waste and leach material removed 20,460,851 tons, or a waste: ore ratio of 1.41: 1.

The remainder of the district output was 241 tons of gold-silver ore produced from the Bell and Climax Lode properties.

MARICOPA COUNTY

Big Horn District.—Leasing operations produced 21 tons of lead ore from the Lead Dike group south of Aguila.

Cave Creek and Camp Creek District.—Output in 1949 was mainly 45 tons of silver-copper ore produced from the Red Rover mine and 19 tons of copper ore from the Womack claim.

Sunflower District.—About 80 tons of silver-lead ore were shipped from the Saddle Mountain (Tri Metals) property, 45 miles northeast of Phoenix.

Vulture District.—Output in 1949 was largely 91 tons of gold ore produced from the Lucky Cuss claim west of Wickenburg.

MOHAVE COUNTY

Cedar Valley District.—In 1949 two mines near Yucca—Antler and Copper World—produced 5,059 tons of zinc-copper ore containing 26 ounces of gold, 3,121 ounces of silver, 278,688 pounds of copper, 60,673 pounds of lead, and 846,280 pounds of zinc. The Antler mine was operated all year by the Yucca Mining & Milling Co. and the Copper World by the Omega Metals Co.; flotation mills were installed at each property during the summer months.

Copper Mountain District.—Leland O. Whitmore operated the Copper Mountain claim in 1949 and shipped 195 tons of ore containing 163 ounces of gold, 1,728 ounces of silver, 12,628 pounds of copper, 8,387 pounds of lead, and 38,094 pounds of zinc.

Owens (McCracken and Potts Mountain) District.—Output in 1949 was principally 262 tons of lead ore produced from the old McCracken and Otsego mines, 45 miles southeast of Yucca, and 112 tons of gold ore from the Esperanza mine.

San Francisco (Oatman, Goldroad, Katherine, Vivian) District.—Lead ore (10 tons) was shipped from the Vivian mine, gold ore (10 tons) from the White Chief claim, and old mill cleanings (1 ton) from the Goldroad property.

Wallapai (Cerbat, Chloride, Mineral Park, Stockton Hill) District.—The output of gold, silver, copper, lead, and zinc in the Wallapai district in 1949 was much less than that in recent years, due chiefly to the closing of the Tennessee mine at Chloride in December 1948. In 1949 the output of the district was largely 4,500 tons of zinc-lead ore produced from the El Oro (Copper Age) mine and treated in the 100-ton flotation mill of the Mohave Lead & Zinc Co.; however, operations ceased in May. The rest of the district output was mainly 137 tons of zinc-lead ore produced from the Mary Bell and Samoa properties, 62 tons of lead-gold ore from the Hidden Treasure mine, 43 tons of gold ore from the Golden Gem mine, and 29 tons of lead ore from the Fountain Head and New London properties.

Weaver District.—Gold ore (99 tons) was shipped in 1949 from the Mocking Bird mine, 45 miles northwest of Kingman, and silver ore (10 tons) from the Weaver claim.

PIMA COUNTY

Ajo District.—The Ajo district continued to rank first in gold and third in copper output in the State, owing to steady operation of the New Cornelia copper mine of the Phelps Dodge Corp. Despite a reduction of the workweek from 6 to 5 days from May to September, the New Cornelia mine produced more copper ore in 1949 than in 1948. According to the annual report of the Phelps Dodge Corp. for 1949, the New Cornelia mine produced 8,122,473 tons of copper ore in 1949 and 5,700,740 tons of waste compared with 7,733,070 tons of ore and

5,970,732 tons of waste in 1948. The company 25,000-ton concentrator treated 8,126,032 tons of copper ore, which yielded 115,744,833 net pounds of copper compared with 110,062,421 net pounds in 1948. Good progress was made during the year on construction of the copper smelter at Ajo, which is expected to be completed and placed in operation in mid-1950.

Arivaca District.—Nearly all output in 1949 was silver-lead ore (32 tons) produced from the Eldorado, Honey House, Mentor, and Silver Flame properties.

Cababi District.—Gold ore (50 tons) was produced from the Cunquian and Sun-Gold claims and silver ore (16 tons) from the Old Timer mine near Sells.

Cerro Colorado District.—Lessees worked the Mary G mine near Amado in 1949 and shipped 93 tons of silver-lead ore to the smelter at El Paso, Tex.

Helvetia (Rosemont) District.—Production of ore in the Helvetia district in 1949 was much lower than in 1948, due to the drop in the prices of copper, lead, and zinc. In 1949 the King in Exile mine produced 2,065 tons of ore containing 2,267 ounces of silver, 212,156 pounds of copper, and 39,694 pounds of zinc. Copper ore (987 tons) was produced also from the Helvetia group and zinc-lead ore (118 tons) from the Daylight and Dimple properties.

Old Hat (Oracle) District.—Leasing operations at the old Leatherwood mine produced 84 tons of copper ore.

Pima (Sierritas, Papago, Twin Buttes) District.—The Pima district again ranked third in output of lead and zinc in Arizona, owing to the large production of zinc-lead ore from the San Xavier mine, near Sahuarita, operated by the Eagle-Picher Mining & Smelting Co. The company reported that the mine produced 82,661 tons of ore in 1949 compared with 72,314 tons in 1948. The ore was treated in the company 500-ton flotation mill, which yielded 12,862 tons of zinc concentrate, 7,291 tons of lead concentrate, and 135 tons of copper concentrate. The rest of the district output was largely 55 tons of silver-lead ore produced from the Dogtown claim and 35 tons of gold ore from the Golden Fleece mine.

Silver Bell District.—Output in 1949 comprised 102 tons of copper ore from the Atlas group, 77 tons of zinc-lead ore from the Silver Lead group, and 2 tons of lead ore from the Lead King claim.

PINAL COUNTY

Casa Grande District.—Sherwood B. Owens continued leasing operations at the Silver Reef mine and shipped 18,621 tons of ore containing 13 ounces of gold, 123,908 ounces of silver, 4,979 pounds of copper, and 2,100 pounds of lead.

Dripping Springs District.—In 1949 the output of the Dripping Springs district in Pinal County was mainly 525 tons of copper-silver ore shipped from the Monitor mine near Ray by various lessees.

Mineral Creek (Ray) District.—Copper ore from the Ray property of the Kennecott Copper Corp. continued to be the most important output in the Mineral Creek district; in 1949 it increased to 1,549,734 tons—a gain of 14,719 tons over 1948. The crude ore, averaging 1.239

percent copper, was coarse-crushed in a 12,000-ton crushing plant at the mine and the resulting product hauled by rail 26 miles to the corporation 10,000-ton flotation mill at Hayden, where it was reduced to 60,053 tons of concentrate containing 338 ounces of gold, 30,656 ounces of silver, and 32,128,350 pounds of copper. In addition, 3,389 tons of copper precipitates were produced, which contained 5,409,580 pounds of copper. According to the annual report of the Kennecott Copper Corp. for 1949, development and stripping of the open pit at Ray have progressed to a point allowing the production of approximately 2,500 tons of pit ore a day. The installation of new equipment to maintain ore production and treatment of 15,000 tons a day from the property is progressing satisfactorily and should be completed toward the end of 1950.

The remainder of the district output was principally 5,424 tons of oxide-copper ore produced from an open pit at the Copper Butte property and 2,135 tons of oxide-lead ore from the Ray Silver-Lead mine.

Mineral Hill District.—In 1949 eight mines in the Mineral Hill district produced 769 tons of ore containing 275 ounces of gold, 1,643 ounces of silver, 6,079 pounds of copper, 56,292 pounds of lead, and 21,510 pounds of zinc. Gold ore (457 tons) was produced from the Kortum, Thanksgiving, and Tom Thumb properties; lead ore (155 tons) from the Silver King mine; silver ore (80 tons) from the Mineral Mountain and Woodpecker claims; zinc-lead ore (53 tons) from the Wedge mine; and copper ore (24 tons) from an old waste dump.

Old Hat (Oracle) District.—About 142,900 tons of ore were produced in the Old Hat district of Pinal County in 1949; most of it was zinc-lead ore produced from the Mammoth-Collins group at Tiger by the St. Anthony Mining & Development Co. The company reported that 142,500 tons of ore, averaging 0.015 ounce of gold and 1.070 ounces of silver to the ton, 0.581 percent copper, 5.360 percent lead, and 5.456 percent zinc, were treated in its 500-ton gravity-flotation mill in 1949 compared with 109,801 tons in 1948. The property ranked second in production of lead in Arizona in 1949 and fourth in zinc. The rest of the district output was largely 263 tons of silver-lead ore produced from the Amphitheater group and 88 tons of zinc-lead ore from the Stove Lid claim. No ore was produced in 1949 from the San Manuel property south of Tiger, owned by the Magma Copper Co.; but, according to the company annual report for 1949, development of the copper-ore body has gone along steadily. No. 1 shaft was sunk 1,145 feet and was 1,270 feet deep at the end of the year; No. 2 shaft was sunk 798 feet and was 988 feet deep at the end of the year. The latter shaft, which was started in Gila conglomerate overburden, passed out of the conglomerate into the monzonite-ore body at a depth of 705 feet; copper in the ore occurs as chalcopyrite.

Pioneer (Superior) District.—In 1949 all the output of the Pioneer district was copper ore and silver ore from the Magma mine (Magma Copper Co.), one of the most important producers of gold, silver, and copper in Arizona. During the year 347,277 tons of copper ore were milled in the company 1,500-ton concentrator, which yielded 74,987

tons of copper concentrate. The concentrate and 31,842 tons of crude copper ore, as well as 1,798 tons of crude silver ore, were sent to the company's 450-ton smelter at Superior. The total ore averaged 0.033 ounce of gold and 1.09 ounces of silver to the ton and 6.14 percent copper. According to the company annual report for 1949, the net metal produced from Magma crude ore and concentrates comprised 11,533 ounces of gold, 371,402 ounces of silver, and 41,003,355 pounds of copper. The average cost of producing copper (after gold and silver values were deducted) was 17.94 cents a pound in 1949 compared with 18.11 cents in 1948. No. 4 section of the old mill was installed in the new mill, which increased the capacity of the new mill to 1,500 tons of copper ore a day or 1,100 tons of copper ore and 350 tons of zinc ore a day. The new mill began operating in January.

SANTA CRUZ COUNTY

Harshaw District.—In 1949 eight properties in the Harshaw district produced 48,189 tons of ore containing 117 ounces of gold, 155,785 ounces of silver, 230,967 pounds of copper, 3,435,814 pounds of lead, and 6,865,226 pounds of zinc. Most of the output was 47,918 tons of zinc-lead-silver ore produced from the Flux-January-Norton group, near Patagonia, by the American Smelting & Refining Co. This tonnage, along with 4,908 tons of ore received from custom shippers, was treated in the company 200-ton flotation mill, which yielded 2,878 tons of lead concentrate and 6,726 tons of zinc concentrate. The remainder of the district output consisted chiefly of 75 tons of lead ore from the Librada and Lenon claims, 73 tons of copper ore from the Volcano mine, 61 tons of silver ore from the Hermosa and World's Fair mines, and 45 tons of zinc-lead ore from the Humboldt mine.

Oro Blanco (Ruby) District.—Output in 1949 was 165 tons of zinc-lead ore from the Choctaw mine, 95 tons of zinc-lead ore and 49 tons of lead ore from the Montana group, and 4 tons of gold ore from the Austerlitz claim.

Patagonia (Duquesne) District.—A. R. Byrd, Jr., worked the Duquesne group all year; hauled 4,295 tons of ore, averaging 4.180 ounces of silver to the ton, 2.196 percent copper, 2.486 percent lead, and 13.274 percent zinc, to a custom flotation mill near Patagonia; and shipped 105 tons of copper ore to the smelter at El Paso, Tex. Zinc-lead-copper ore (683 tons) was produced also from the Pride of the West mine and treated in a custom flotation mill. The rest of the district output was mainly 67 tons of lead ore and slag shipped from the Mowry property and 47 tons of zinc-lead-copper ore produced from the Happy Thought mine.

Tyndall District.—In 1949 six mines in the Tyndall district produced 541 tons of ore containing 13 ounces of gold, 2,096 ounces of silver, 15,398 pounds of copper, 82,641 pounds of lead, and 45,546 pounds of zinc. Zinc-lead-copper ore (218 tons) was produced from the Compadre and Royal Blue mines; zinc-lead ore (161 tons) from the Glove and Jefferson mines; and lead ore (137 tons) from the Amado, Jefferson, and Wilkins properties. In addition to zinc-lead-copper ore, the Compadre mine also produced 25 tons of zinc ore.

YAVAPAI COUNTY

Agua Fria District.—Operators of two mines—Copper Queen and Stoddard—shipped 527 tons of high-silica copper ore to the United Verde smelter at Clarkdale.

Big Bug District.—In 1949 the Big Bug district ranked second in gold and zinc production in the State, third in silver, and fourth in lead. The Iron King mine of the Shattuck Denn Mining Corp. continued to be the principal producer; output was 175,111 tons of zinc-lead-iron ore, 346 tons of gold-silver ore, and 1,395 tons of gold-iron tailings. The zinc-lead-iron ore, which averaged 0.124 ounce of gold and 4.215 ounces of silver to the ton, 0.162 percent copper, 2.422 percent lead, 6.754 percent zinc, and 22 percent iron, was treated in the company 670-ton flotation mill, as well as 923 tons of custom ore. The mill yielded 13,455 tons of lead concentrate, 16,272 tons of zinc concentrate, and 15,067 tons of iron-gold concentrate. Additional equipment installed in the mill during the year increased the capacity from 470 tons of ore a day to 670 tons.

The remainder of the district lode output was largely 128 tons of copper ore produced from the Henrietta, Lone Pine, and Spar & Durant mines and 102 tons of gold ore from the M. & W., Silverton-Gopher, and Up Shot groups. Placer gold (54 ounces) was recovered from the Jane, Shanks, and Nelson-Fitch properties.

Black Canyon District.—Gold ore (400 tons) produced from the French Lilly group near Cleator was treated by flotation. The rest of the district output was mainly 41 tons of gold-silver ore and 13 tons of gold-lead ore produced from the Golden Turkey mine.

Black Hills District.—A lessee worked the Yaeger waste dump in 1949 and shipped 52 tons of copper ore and 61 tons of old lead slag.

Black Rock District.—Output in 1949 was small lots of gold ore, copper ore, and lead ore produced from various claims and sold to the Wickenburg Ore Market; most of it was 52 tons of copper ore produced from the B. O. A. claim.

Blue Tank District.—E. Nutter continued working the Camp B. mine near Wickenburg, treated 60 tons of copper ore by concentration, and shipped 37 tons of similar ore to a smelter.

Copper Basin District.—The Copper Basin group, formerly known as Commercial mine, was operated under lease by Fred D. Schemmer, who shipped 3,818 tons of high-silica copper ore to the United Verde smelter at Clarkdale. The remainder of the district output was principally 89 tons of zinc-lead ore produced from the "U. S. Navy" mine.

Eureka (Bagdad) District.—Output in 1949 was mainly 1,058,311 tons of copper ore produced from the open pit at the Bagdad mine, 13,640 tons of zinc-lead-gold ore from the Hillside mine, 8,808 tons of zinc-copper ore from the Old Dick mine, and 2,006 tons of zinc ore from the Copper King mine. The Bagdad Copper Corp. worked the Bagdad open pit continuously and treated ore averaging 1.009 percent copper in its 3,000-ton flotation mill. Mining and milling of ore, averaging 0.10 ounce of gold and 2.20 ounces of silver to the ton, 1.01 percent lead, and 1.98 percent zinc, from the Hillside mine by the Hillside Mining & Milling Co. were carried on throughout the year. The Old Dick mine produced 8,808 tons of zinc-copper ore and 220 tons

of copper ore; the zinc-copper ore, which contained 51 ounces of gold, 4,913 ounces of silver, 600,300 pounds of copper, 55,290 pounds of lead, and 3,834,630 pounds of zinc, was shipped to custom mills in Arizona and Utah for treatment. Zinc ore produced from the Copper King mine contained 15 ounces of gold, 4,272 ounces of silver, 79,852 pounds of copper, 69,498 pounds of lead, and 1,141,656 pounds of zinc. Other producers included the Pinafore (407 tons of zinc-copper ore and 6 tons of copper ore); Attempt (36 tons of lead ore); and Vidano No. 3 (34 tons of lead ore).

Hassayampa (Groom Creek, Hassayampa River, Senator, Prescott) District.—In 1949 the output of the Hassayampa district consisted largely of 279 tons of gold-lead ore produced from the Bodie mine, 192 tons of zinc-lead ore from the Cash, Ruth, Sacramento, and Senator properties, 109 tons of gold ore from the Cash, Gold Charm, and Senator properties, and 47 tons of silver ore from the Mark Twain claim.

Lynx Creek District.—Dragline dredging at the Fitzmaurice placer near Prescott from February 20 to June 20 by the Minona Mining Co. recovered 365 fine ounces of gold and 52 fine ounces of silver.

Martinez (Congress) District.—Lessees, operating at the old Congress mine, shipped 62 tons of gold ore.

Minnehaha District.—High-grade silver ore (19 tons) was produced in 1949 from the Little Joker claim 9 miles southeast of Wagoner.

Pine Grove (Crown King) District.—E. M. Moores, Jr., worked the Gladiator and War Eagle mines in 1949 and shipped 366 tons of ore containing 209 ounces of gold, 1,550 ounces of silver, and 3,350 pounds of copper. The rest of the district output was 31 tons of gold-lead ore produced from the Del Pasco group.

Tiger District.—The Tiger mine, 5 miles southwest of Crown King, was worked only the first quarter of the year by the Golden Crown Mining Co.; 700 tons of zinc-lead-silver ore were treated in the Crown King flotation mill. The remainder of the district output was chiefly 57 tons of high-grade gold ore produced from the Arizona Mascot, Camp Bird, and Pilgrim properties.

Tip Top (Rock Springs) District.—Output in 1949 was 163 tons of copper ore produced from the Kay mine by the Black Canyon Copper Co., Inc.

Verde (Jerome) District.—A notable production of zinc was made in the Verde district in 1949, owing to a full year's operation of the zinc-copper ore body at the United Verde mine of the Phelps Dodge Corp.; and substantial increases were recorded in the production of gold, silver, and copper. However, copper ore from the mine remained the most important output in the district, although production declined 11 percent from that in 1948. The corporation reported that 297,161 tons of copper ore and 111,290 tons of zinc-copper ore were produced in 1949 compared with 332,924 and 14,235 tons, respectively, in 1948. All the zinc-copper ore and 132,950 tons of copper ore were treated in the corporation 2,100-ton flotation mill. The copper concentrate (85,496 tons), along with 164,211 tons of crude copper ore and 175 tons of copper precipitates, was shipped direct to the corporation smelter at Clarkdale. The zinc concentrate (10,384 tons) was shipped to a zinc smelter at Dumas, Tex.

According to the annual report of the corporation for 1949, the United Verde branch produced 34,477,880 net pounds of copper in 1949 compared with 29,833,400 net pounds in 1948, and 8,005,488 pounds of zinc were recovered. No important ore discoveries were made, and because of exhaustion of copper ore reserves it is probable that mining will be discontinued in 1951.

The remainder of the district output was 2,156 tons of siliceous ore and 10 tons of copper precipitates shipped to the smelter at Clarkdale from the Verde Exploration property; the ore averaged 0.336 ounce of gold and 2.149 ounces of silver to the ton and 2.174 percent copper.

Walker District.—In 1949 seven mines in the Walker district produced 499 tons of ore containing 170 ounces of gold, 1,660 ounces of silver, 2,409 pounds of copper, 71,030 pounds of lead, and 90,562 pounds of zinc. The New Strike and Pine Mountain properties produced 310 tons of zinc-lead ore and the Forshada claim 99 tons of zinc-lead ore and 71 tons of lead ore. The remainder of the district output was chiefly 17 tons of high-grade gold-lead ore produced from the Emma and Oro Plata claims.

YUMA COUNTY

Castle Dome District.—About 450 tons of oxide lead ore were produced from the Big Jim and DeLuce properties in 1949 and treated in small gravity-concentration mills. The rest of the district output was mainly small lots of high-grade lead ore produced from various prospects and sold to the Wickenburg Ore Market.

Cienega District.—The Empire-Arizona group, 12 miles northeast of Parker, was worked all year by the Lucky Tiger Combination Gold Mining Co.; 1,613 tons of ore were shipped containing 363 ounces of gold, 203 ounces of silver, and 80,871 pounds of copper. The remainder of the district output was principally 128 tons of gold-copper ore produced from the Billy Mack and Golden Ray mines and 79 tons of copper ore from the Mammon and Sue mines.

Ellsworth (Harqua Hala) District.—Output in 1949 was mostly 49 tons of copper ore produced from the Mickey Doolan and Yuma Copper properties and 48 tons of gold ore from the Bettle No. 1 claim.

Eureka (Silver Camp) District.—Zinc-lead ore (1,740 tons) from the waste dump at the Red Cloud mine was treated in a 20-ton concentration mill, and small lots of lead ore were produced from the Black Jack and Horse Shoe claims.

Plomosa District.—The Southern Cross Mining Corp. worked the Lucky Lead group near Bouse and shipped 406 tons of ore containing 9 ounces of gold, 1,668 ounces of silver, and 142,261 pounds of lead. The rest of the district lode output was mainly 118 tons of silver-lead ore produced from the R. & A. mine and 40 tons of gold-copper ore from the Coronation group. Dragline dredging at the N. R. A. placer near Quartzite recovered 50 fine ounces of gold and 10 fine ounces of silver.

California

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By R. B. Maurer

GENERAL SUMMARY

CALIFORNIA lead production in 1949 reached a level exceeded only in the war year 1917. Despite production curtailments at zinc mines after midyear, output of the metal surpassed 1948 yield by a substantial margin, reversing the downward trend begun in 1946. Due to notably lower output from placer mines, gold production in 1949 fell short of the 1948 level, whereas silver and copper—largely byproduct metals in 1949—were both above their respective 1948 outputs. The total value of the five metals in 1949 was $20,616,562, or nearly 2 percent above 1948. It was divided among the metals as follows: Gold, 71 percent; lead, 16 percent; zinc, 9 percent; silver, 3 percent; and copper, 1 percent. Comparing 1949 with 1948, gold decreased 1 percent in quantity and value; silver increased 8 percent in quantity and value; copper increased 35 percent in quantity and 22 percent in value; lead increased 13 percent in quantity but decreased a fraction of 1 percent in value; and zinc increased 35 percent in quantity and 26 percent in value. Inyo County was the largest contributor to metal-mining output in California, due largely to lead and zinc production as well as to note-worthy quantities of gold, silver, and copper; the county supplied 24 percent of the State total value of the five metals. Nevada County ranked second in 1949, largely from gold ore mined in the Grass Valley-Nevada City district, and produced 19 percent of the total value of the five metals. Sacramento County, which occupied second place in 1948, contributed 18 percent of the total value of the five metals in 1949, mainly from large-scale gold dredging in the Folsom district. Thus, 61 percent of the State output was centered in 3 of the 58 counties.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of metal production reported herein has been calculated at the following prices.

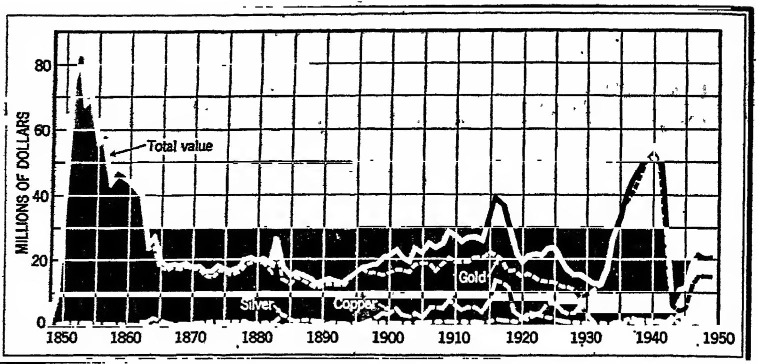

FIGURE 1.—Value of mine production of gold, silver, and copper, and total value of gold, silver, copper, lead, and zinc in California, 1848–1949. The value of lead and zinc has exceeded $1,000,000 in only a few years.

Prices of gold, silver, copper, lead, and zinc—1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837 to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price of newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Gold.—Production of gold (including a relatively small quantity in "natural gold" and amalgam sold in the open market) from California mines in 1949 was 1 percent below the 1948 output, owing to a 12-percent (35,008-ounce) reduction in yield from placer operations—principally bucket-line dredging—in contrast to a 23-percent (30,766-ounce) increase in lode-gold output. The Empire Star Mines, Ltd., mines in Nevada and Yuba Counties and the Idaho Maryland Mines Corp. properties in Nevada County, largely lessee-operated, and the Central Eureka Mining Co. in Amador County, which effected operational savings by new wage agreements, were able to increase gold output substantially in 1949 despite the fixed price for the metal. The low monthly output in January was followed by fluctuating production from February through November, but a trend toward increasingly larger average monthly yield was evident; maximum monthly output for the year was attained in December.

The 20 leading gold-producing mines in California in 1949, listed in an accompanying table, yielded 89 percent of the total gold, the 5 leaders producing 61 percent.

Mine production of gold, silver, copper, lead, and zinc in California, 1945–49, and total, 1848–1949, in terms of recoverable metals

Year	Mines producing [1]		Ore, old tailings etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	87	99	717,969	147,938	$5,177,830	986,798	$701,723
1946	150	172	627,767	356,824	12,488,840	1,342,651	1,084,862
1947	210	210	648,789	431,415	15,099,525	1,597,442	1,445,685
1948	241	195	526,776	421,473	14,751,555	724,771	655,954
1949	242	190	494,906	417,231	14,603,085	783,880	709,451
1848–1949			(2)	103,151,338	2,312,400,482	111,306,181	89,952,032

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	6,473	$1,747,710	7,224	$1,242,528	9,923	$2,282,290	$11,152,081
1946	4,240	1,373,760	9,923	2,163,214	6,877	1,677,988	18,788,664
1947	2,407	1,010,940	10,080	2,903,040	5,415	1,310,430	21,769,620
1948	481	208,754	9,110	3,261,380	5,325	1,416,450	20,294,093
1949	649	255,706	10,318	3,260,488	7,209	1,787,832	20,616,562
1848–1949	629,361	202,769,264	189,160	30,067,925	98,156	20,373,108	2,655,562,811

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Figure not available

Gold production at placer mines in California, by classes of mines and methods of recovery, 1945–49, and total, 1848–1949 [1]

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered: Fine ounces	Gold recovered: Value	Gold recovered: Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucket-line dredges:						
1945	16	26	30,738,000	88,318	$3,091,130	$0.101
1946	22	32	78,175,000	244,679	8,563,765	.110
1947	22	35	95,478,000	271,165	9,490,775	.099
1948	22	35	94,747,200	257,171	9,000,985	.095
1949	20	34	83,571,900	226,838	7,939,330	.095
Drag-line dredges:						
1945	6	6	414,400	1,242	43,470	.105
1946	39	38	4,309,000	16,932	592,620	.138
1947	41	35	5,718,000	26,617	931,595	.163
1948	27	27	3,033,000	17,029	596,015	.197
1949	28	24	2,906,600	14,616	511,560	.176
Suction dredges: [3]						
1945	----------	----------	----------	----------	----------	----------
1946	1	1	22,900	112	3,920	.171
1947	7	5	60,000	485	16,975	.283
1948	5	6	83,000	453	15,855	.191
1949	10	11	267,000	1,364	47,740	.179
Nonfloating washing plants: [4]						
1945	8	8	519,300	974	34,090	.066
1946	13	13	771,000	2,576	90,160	.117
1947	25	25	261,000	3,916	137,060	.525
1948	15	15	261,700	1,159	40,565	.155
1949	25	26	256,500	3,452	120,820	.471
Gravel hydraulically handled:						
Hydraulic:						
1945	17	----------	282,300	922	32,270	.114
1946	17	----------	443,300	1,147	40,145	.091
1947	23	----------	332,000	1,194	41,790	.126
1948	28	----------	363,000	1,784	62,440	.172
1949	27	----------	447,900	1,587	55,545	.124
Small-scale hand methods: [5]						
Wet:						
1945	45	----------	88,300	1,526	53,410	.605
1946	72	----------	624,000	4,165	145,775	.234
1947	86	----------	682,000	8,931	312,585	.458
1948	83	----------	211,300	7,704	269,640	1.276
1949	67	----------	125,400	2,576	90,160	.719
Dry:						
1945	----------	----------	----------	----------	----------	----------
1946	1	----------	100	3	105	1.050
1947	3	----------	600	6	210	.350
1948	2	----------	600	27	945	1.688
1949	1	----------	660	20	700	1.061
Underground placers:						
Drift:						
1945	7	----------	2,700	498	17,430	6.456
1946	7	----------	5,700	158	5,530	.970
1947	3	----------	1,400	224	7,840	5.600
1948	13	----------	14,100	229	8,015	.569
1949	12	----------	1,500	95	3,325	2.217
Grand total placers:						
1945	99	----------	32,045,000	93,480	3,271,800	.102
1946	172	----------	84,351,000	269,772	9,442,020	.112
1947	210	----------	102,533,000	312,538	10,938,830	.107
1948	195	----------	98,713,900	285,556	9,994,460	.101
1949	190	----------	87,577,460	250,548	8,769,180	.100
1848–1949 [1]	----------	----------	(6)	66,381,436	1,459,087,906	(6)

[1] For historical data by years, see Minerals Yearbook, Review of 1940, p. 219.

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Includes all placer operations using suction pump for delivering gravel to floating washing plants except those producing less than 100 ounces of gold, which are included with "small-scale hand methods."

[4] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

[5] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.

[6] Complete data not available.

Twenty leading gold-producing mines and 10 leading silver-producing mines in California in 1949, in order of output

Rank	Mine	District	County	Rank in 1948	Operator	Source of metal
		GOLD-PRODUCING MINES				
1	Natomas	Folsom	Sacramento	1	Natomas Co	Dredge.
2	Idaho and Brunswick units	Grass Valley-Nevada City	Nevada	3	Idaho MarylandMines Corp	Gold ore.
3	Yuba unit	Yuba River	Yuba	2	Yuba Consolidated Gold Fields	Dredge.
4	Empire Star group	Grass Valley-Nevada City	Nevada	4	Empire Star Mines Co., Ltd	Gold ore.
5	Capital dredges	Folsom	Sacramento	5	Capital Dredging Co	Dredge.
6	Old Eureka	Mother Lode	Amador	26	Central Eureka Mining Co	Gold ore.
7	Butte unit	Oroville	Butte	6	Yuba Consolidated Gold Fields	Dredge.
8	Snelling dredge	Snelling	Merced	7	Snelling Gold Dredging Co	Do.
9	Original Sixteen to One	Alleghany	Sierra	16	Original Sixteen to One Mine, Inc	Gold ore.
10	La Grange dredge No. 4	La Grange	Stanislaus	12	La Grange Gold Dredging Co	Dredge.
11	Thurman dredge	Redding	Shasta	10	Thurman Gold Dredging Co	Do.
12	Siskiyou unit	Callahan	Siskiyou	8	Yuba Consolidated Gold Fields	Do.
13	Kister dredge	Oroville	Butte	9	Gold Hill Dredging Co	Do.
14	Cosumnes dredge	Cosumnes River	Sacramento	14	Cosumnes Gold Dredging Co	Do.
15	General dredge	Folsom	do	17	General Dredging Co	Do.
16	Indian Creek placer	Deadwood	Siskiyou	13	French Gulch Dredging Co	Do.
17	Lower Comanche dredge	Camanche	San Joaquin	31	Gold Hill Dredging Co	Do.
18	Tropico (Kid, Trailer Wheel)	Mojave	Kern	22	Burton Bros	Gold ore.
19	Dredge No. 8	Hunter Valley	Mariposa	30	Thurman & Wright	Dredge.
20	Shoshone group	Resting Springs	Inyo	39	Anaconda Copper Mining Co	Lead ore.
		SILVER-PRODUCING MINES				
1	Darwin group	[illegible]	Inyo	1	Anaconda Copper Mining Co	Zinc-lead and lead ores.
2	Shoshone group	[illegible] Springs	do	2	do	Lead ore.
3	Afterthought	[illegible]	Shasta	11	Coronado Copper & Zinc Co	Zinc ore.
4	Defense	do	Inyo	3	Foreman & Skinner	Lead ore.
5	Pine Creek	[illegible] (Bishop Creek) (Pine [illegible])	do	4	United States Vanadium Corp	Tungsten ore.
6	Empire Star group	[illegible] Valley-Nevada City	Nevada	9	Empire Star Mines Co., Ltd	Gold ore.
7	Idaho and Brunswick units	do	do	7	Idaho Maryland Mines Corp	Do.
8	Cactus Queen	Mojave	Kern	15	Burton Bros	Gold-silver ore.
9	Reward (Brown Monster)	Independence	Inyo	18	Walter Wilson and others	Lead, gold and gold-silver ores.
10	Penn	Campo Seco	Calaveras	[1]	Penn Chemical Co	Zinc ore.

[1] Did not produce in 1948.

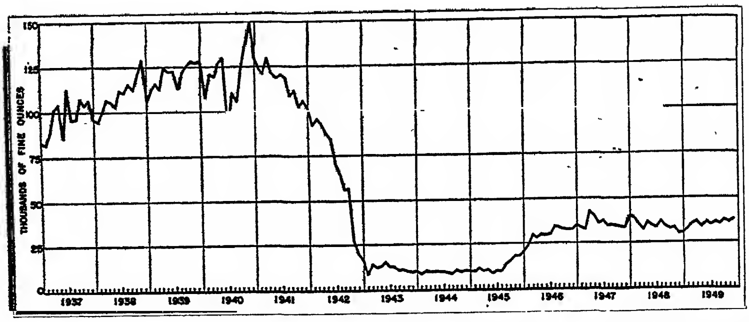

FIGURE 2.—Mine production of gold in California, 1937–49, by months, in terms of recoverable gold.

Silver.—Of California's total recoverable silver in 1949, nearly 88 percent was derived from base-metal ores and 12 percent from precious metal ores and gravels; less than 1 percent was recovered from straight silver ore. The 10 leading silver-producing mines listed in an accompanying table yielded 90 percent of the State total silver in 1949; the three leading mines yielded 73 percent.

The combined output from Anaconda Copper Mining Co. Darwin group of mines, Coso district, Inyo County, and Shoshone group of mines, Resting Springs district, Inyo County, establishes the trend in State silver production as shown by months in 1949.

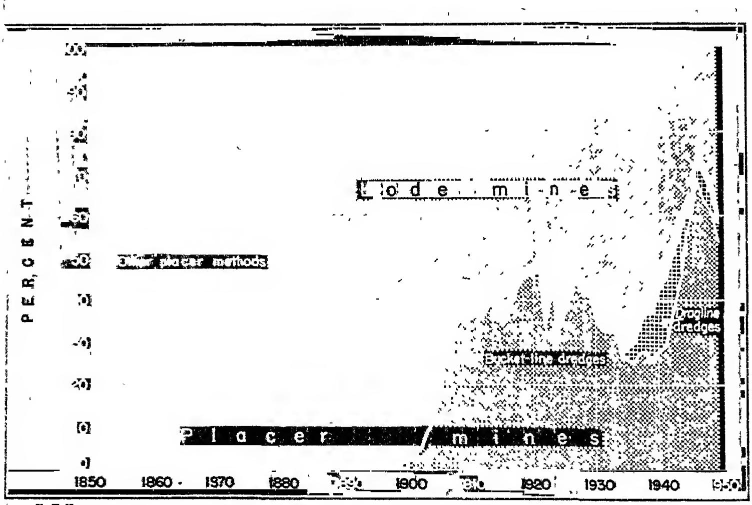

FIGURE 3.—Percentage of total California gold produced at lode and placer mines and by various methods of placer mining, 1850–1949.

Mine production of gold, silver, copper, lead, and zinc in California in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	30,522	62,090	78	805	614
February	32,471	73,047	71	1,001	818
March	35,069	72,525	109	930	1,077
April	36,044	81,968	67	877	963
May	33,210	78,382	80	849	831
June	35,622	65,808	64	901	641
July	34,396	30,096	27	444	96
August	35,494	30,069	35	350	158
September	34,658	54,973	30	702	293
October	36,921	80,616	35	1,108	654
November	35,596	75,457	24	1,121	528
December	37,228	78,849	29	1,230	536
Total: 1949	417,231	783,880	649	10,318	7,209
1948	421,473	724,771	481	9,110	5,325

Copper.—As in 1948, the copper produced in California in 1949 was largely a byproduct of ores mined primarily for other metals. The leading producers of copper in the State were the Coronado Copper & Zinc Co. Afterthought mine, Cow Creek district, Shasta County (zinc ore); United States Vanadium Corp. Pine Creek mine, Bishop district, Inyo County (tungsten ore); and Anaconda Copper Mining Co. Darwin group, Coso district, Inyo County (zinc-lead and lead ores).

Lead.—Lead output of 20,636,000 pounds in 1949 was the largest since 1917, the peak year. The State production, associated with zinc, was centered in the Coso and Resting Springs districts of Inyo County, and the monthly production figures in an accompanying table follow a trend allied to the two leading lead-producing mines in the State—the Anaconda Copper Mining Co. Darwin and Shoshone properties. Cessation of operations at the Darwin group in July, August, and part of September, following reduction of lead prices in June, is reflected in the State total yield of the metal. Increased output of lead from October through December resulted from expanded production at both the Darwin and Shoshone groups. Other important producers in California, in order of recoverable lead output, were: Coronado Copper & Zinc Co. Afterthought mine, Cow Creek district, Shasta County; and Foreman & Skinner Defense mine and Finley & Vignich Minnietta mine, Modoc district, Inyo County. Data on a lead-zinc mine were published.[1]

Zinc.—State zinc production in 1949 was kept at a relatively high level from January through May by the yield from the two leading mines—Anaconda Copper Mining Co. Darwin group and Coronado Copper & Zinc Co. Afterthought mine—augmented by the output of the Carbonate King zinc mine,[2] Ivanpah district, Inyo County, and some recoverable zinc from the Anaconda Shoshone group and small producers. The impact of zinc price reductions in June was felt immediately, and by July California's two leading zinc mines had

[1] Matson, E. J., Investigation of Rush Creek Lead-Zinc Deposit, Mono County, Calif.: Bureau of Mines Rept. of Investigations 4453, 1949, 4 pp.

[2] Wiebelt, Frank J., Investigation of Carbonate King Zinc Mine (Crystal Cave Group), San Bernardino County, Calif.: Bureau of Mines Rept. of Investigations 4522, 1949, 10 pp.

ceased operations. Zinc production in August was increased slightly by larger output from the Penn Chemical Co. Penn mine, Campo Seco district, Calaveras County. Anaconda Copper Mining Co., the State's sole zinc producer operating at the close of 1949, resumed mining and milling at its Darwin group in September, and normal production was maintained from October through December.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in California in 1949, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold					
			Lode		Placer		Total	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	10	11	18,551	$649,285	671	$23,485	19,222	$672,770
Butte	2	10	19	665	23,435	820,225	23,454	820,890
Calaveras	11	4	2,839	99,365	184	6,440	3,023	105,805
El Dorado	8	12	1,071	37,485	2,043	71,505	3,114	108,990
Fresno and Humboldt [2]		4			222	7,770	222	7,770
Imperial	1		32	1,120			32	1,120
Inyo	44	1	4,003	140,105	9	315	4,012	140,420
Kern	25	3	5,447	190,645	267	9,345	5,714	199,990
Los Angeles	3	2	92	3,220	157	5,495	249	8,715
Madera	2	8	29	1,015	1,204	42,140	1,233	43,155
Mariposa	21	7	2,777	97,195	3,904	136,640	6,681	233,835
Merced		3			12,357	432,495	12,357	432,495
Modoc	1		9	315			9	315
Mono and Monterey [2]	3		45	1,575			45	1,575
Nevada	12	12	[3] 114,110	[3] 3,993,850	2,373	83,055	[3] 116,483	[3] 4,076,905
Placer	3	15	946	33,110	498	17,430	1,444	50,540
Plumas	7	5	33	1,155	647	22,645	680	23,800
Riverside	6		47	1,645			47	1,645
Sacramento	1	12	30	1,050	105,746	3,701,110	105,776	3,702,160
San Bernardino	32	3	2,054	71,890	496	17,360	2,550	89,250
San Diego	1		3	105			3	105
San Francisco		1			3	105	3	105
San Joaquin and Stanislaus [2]		6			15,328	536,480	15,328	536,480
Shasta	13	4	663	23,205	7,345	257,075	8,008	280,280
Sierra	5	15	13,242	463,470	258	9,030	13,500	472,500
Siskiyou	12	22	204	7,140	15,014	525,490	15,218	532,630
Trinity	6	20	82	2,870	3,156	110,460	3,238	113,330
Tulare		1			26	910	26	910
Tuolumne	12	1	355	12,425	17	595	372	13,020
Yuba	1	8	(3)	(3)	55,188	1,931,580	[3] 55,188	[3] 1,931,580
Total: 1949	242	190	166,683	5,833,905	250,548	8,769,180	417,231	14,603,085
1948	241	195	135,917	4,757,695	285,556	9,994,460	421,473	14,751,555

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California in 1949, by counties, in terms of recoverable metals—Continued

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	4,120	$3,729	92	$83	4,212	$3,812
Butte	3	3	1,571	1,422	1,574	1,425
Calaveras	9,012	8,156	22	20	9,034	8,176
El Dorado	482	436	305	276	787	712
Fresno and Humboldt [2]	—	—	32	29	32	29
Imperial	9	8	—	—	9	8
Inyo	591,391	535,239	—	—	591,391	535,239
Kern	17,490	15,829	65	59	17,555	15,888
Los Angeles	99	90	24	21	123	111
Madera	8	7	334	302	342	309
Mariposa	853	772	869	786	1,722	1,558
Merced	—	—	1,139	1,031	1,139	1,031
Modoc	3	3	—	—	3	3
Mono and Monterey [2]	1,166	1,055	—	—	1,166	1,055
Nevada	[3] 34,686	[3] 31,392	276	250	[3] 34,962	[3] 31,642
Placer	1,292	1,169	56	51	1,348	1,220
Plumas	18	16	62	56	80	72
Riverside	951	861	—	—	951	861
Sacramento	5	5	4,929	4,461	4,934	4,466
San Bernardino	26,148	23,665	89	81	26,237	23,746
San Diego	2	2	—	—	2	2
San Francisco	—	—	1	1	1	1
San Joaquin and Stanislaus [2]	—	—	1,414	1,280	1,414	1,280
Shasta	75,637	68,455	807	730	76,444	69,185
Sierra	2,573	2,329	33	30	2,606	2,359
Siskiyou	35	32	1,952	1,766	1,987	1,798
Trinity	24	22	399	361	423	383
Tulare	—	—	4	4	4	4
Tuolumne	76	69	2	2	78	71
Yuba	([3])	([3])	3,320	3,005	[3] 3,320	[3] 3,005
Total: 1949	766,083	693,344	17,797	16,107	783,880	709,451
1948	703,289	636,512	21,482	19,442	724,771	655,954

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Amador	300	$59	100	$16	—	—	$676,657
Butte	—	—	—	—	—	—	822,315
Calaveras	76,500	15,070	33,300	5,261	726,700	$90,111	224,423
El Dorado	—	—	—	—	—	—	109,702
Fresno and Humboldt [2]	—	—	—	—	—	—	7,799
Imperial	—	—	—	—	—	—	1,128
Inyo	421,300	82,996	19,659,100	3,106,138	8,952,200	1,110,073	4,974,866
Kern	—	—	—	—	—	—	215,878
Los Angeles	—	—	—	—	—	—	8,826
Madera	—	—	—	—	—	—	43,464
Mariposa	200	39	—	—	—	—	235,432
Merced	—	—	—	—	—	—	433,526
Modoc	—	—	—	—	—	—	318
Mono and Monterey [2]	100	20	300	47	—	—	2,697
Nevada	—	—	900	142	—	—	[3] 4,108,689
Placer	—	—	—	—	—	—	51,760
Plumas	3,500	690	—	—	—	—	24,562
Riverside	5,100	1,005	31,500	4,977	—	—	8,488
Sacramento	—	—	—	—	—	—	3,706,626
San Bernardino	135,500	26,694	320,700	50,671	618,300	76,669	267,030
San Diego	—	—	—	—	—	—	107
San Francisco	—	—	—	—	—	—	106
San Joaquin and Stanislaus [2]	—	—	—	—	—	—	537,760
Shasta	653,900	128,818	589,900	93,204	4,120,800	510,979	1,082,466
Sierra	—	—	—	—	—	—	474,859
Siskiyou	1,600	315	—	—	—	—	534,743
Trinity	—	—	—	—	—	—	113,713
Tulare	—	—	—	—	—	—	914
Tuolumne	—	—	200	32	—	—	13,123
Yuba	—	—	—	—	—	—	[3] 1,934,585
Total: 1949	1,298,000	255,706	20,636,000	3,260,488	14,418,000	1,787,832	20,616,562
1948	962,000	208,754	18,220,000	3,261,380	10,650,000	1,416,450	20,294,093

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Combined to avoid disclosure of individual output.
[3] Yuba County lode gold and lode silver included with Nevada County.

MINING INDUSTRY

The 6-percent decrease in total tonnage of ores and old tailings treated in 1949 compared with 1948 reflected a marked decrease in dry ores and an increase in all base-metal ores except zinc-lead ore. The yardage at placer mines decreased 11 percent. The output of lode gold advanced 23 percent; but the gold from this source comprised only 40 percent of the State total, whereas production from placer mines decreased 12 percent and represented 60 percent of the total. The average recoverable gold content of gravel decreased 1 percent.

Dredges of the bucket-line type washed 95 percent of the total gravel mined in the State in 1949 and recovered 91 percent of the total placer gold. Productivity of dragline dredging declined in 1949; equipment of this type washed 3 percent of the total gravel handled and recovered 6 percent of the placer gold. Eleven suction dredges operated in 1949 compared to 6 in 1948 and more nonfloating washing plants (used in conjunction with mechanical excavators) were worked in 1949 than the previous year. In contrast, the number of properties mining gravel and recovering gold largely by hand methods decreased in 1949.

ORE CLASSIFICATION

Of the 494,906 tons of ore (including 2,949 tons of old tailings) sold or treated in 1949, 76 percent was gold ore and old tailings, more than 11 percent zinc-lead ore, 8 percent lead ore, 4 percent zinc ore, and nearly 1 percent gold-silver ore, silver ore and old tailings, copper ore, and lead-copper ore combined. Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore and old tailings sold or treated in California in 1949, with content in terms of recoverable metals

Source	Material sold or treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
Dry gold ore	373,532	949	161,690	59,108	92,000	5,200	
Dry gold-silver ore	2,305		387	13,916	400	19,000	
Dry silver ore	141	2,000	6	6,122	100	12,000	
Total	375,978	2,949	162,083	79,146	92,500	36,200	
Copper ore	[1] 250		[2] 64	[3] 28,442	[4] 367,500		
Lead ore	37,553		3,738	305,934	103,000	12,572,300	1,120,100
Lead-copper ore	106		2	577	2,200	18,500	
Zinc ore	21,078		641	83,509	631,900	632,900	5,464,700
Zinc-lead ore	56,992		155	268,475	100,900	7,376,100	7,833,200
Total lode mines	[1] 491,957	2,949	[2] 166,683	[3] 766,083	[4] 1,298,000	20,636,000	14,418,000
Placers			250,548	17,797			
Total: 1949	[1] 491,957	2,949	[2] 417,231	[3] 783,880	[4] 1,298,000	20,636,000	14,418,000
1948	[1] 515,893	10,883	[2] 421,473	[3] 724,771	[3] 962,000	18,220,000	10,650,000

[1] Excludes tungsten ore.
[2] Includes metal recovered from tungsten ore.
[3] Includes metal recovered from tungsten ore and pyritic ore (residue).
[4] Includes metal recovered from tungsten ore and pyritic ore (residue); also includes 60,100 pounds from precipitates and 2,000 pounds from furnace matte.

METALLURGIC INDUSTRY

During 1949, 94 percent of the total ore and old tailings handled was treated at mills, and 6 percent was shipped for direct smelting. Of the 23,289 tons of concentrates (22,156 tons in 1948) received by smelters, 49 percent was zinc concentrate, 38 percent lead concentrate, 8 percent lead-copper concentrate, nearly 3 percent gold concentrate, and 2 percent copper concentrate. A negligible quantity of silver concentrate was smelted. The tonnage of crude ore and old tailings smelted decreased 18 percent, whereas the quantity of ore and old tailings milled decreased 5 percent.

Companies producing most of the State lode gold and those mines that concentrated the bulk of California's base-metal ores operated their own metallurgical plants. Included with the few mills that did receive custom ore were: Burton Bros. Inc., Rosamond (treatment by cyanidation), and Butte Lode Mining Co., Randsburg (amalgamation), both in Kern County; and the Reward mill (Walter Wilson), Independence, Inyo County (concentration). The Empire Star Mines Co., Ltd., Grass Valley, Nevada County, cyanided small lots of concentrates and milled small tonnages of gold ore. The lead plant of the American Smelting & Refining Co. at Selby, Contra Costa County—the State's only smelter treating principally nonferrous primary materials—operated from January to late in November 1949 when a labor dispute resulted in a strike which closed the operation December 1. Metallurgical data on gold and zinc ores were published.[3]

Mine production of metals in California in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Amalgamation	98,630	19,594			
Cyanidation	55,728	43,554			
Concentrates smelted	7,437	413,509	975,300	10,099,600	12,738,600
Ore and old tailings smelted	4,888	289,426	262,600	10,536,400	1,679,400
Precipitates smelted			60,100		
Placer	250,548	17,797			
Total: 1949	417,231	783,880	1,298,000	20,636,000	14,418,000
1948	421,473	724,771	962,000	18,220,000	10,650,000

[3] Engle, A. L., and Heinen, J. H., Preliminary Tests of Gold and Zinc Ores from Buzzard Mine, Placerville, Calif.: Bureau of Mines Rept. of Investigations 4615, 1949, 12 pp.

Mine production of metals from mills in California in 1949, by counties and classes of concentrates smelted, in terms of recoverable metals

	Material treated		Recoverable in bullion		Concentrates smelted and recoverable metal [2]					
	Ore [1] (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES										
Amador	41,973	850	15,804	3,268	227	2,701	824	300	100	----------
Butte	65	-------	19	3	-------	-------	-------	-------	-------	-------
Calaveras	11,953	-------	2,107	678	1,027	722	8,316	76,500	33,300	726,700
El Dorado	15,047	-------	985	282	14	86	200	-------	-------	-------
Inyo and Shasta [3]	84,681	2,035	182	316	21,767	1,513	402,610	898,200	10,061,500	12,011,900
Kern	9,470	-------	4,938	17,134	18	507	252	-------	-------	-------
Los Angeles	295	-------	52	17	3	27	64	-------	-------	-------
Madera	70	-------	29	8	-------	-------	-------	-------	-------	-------
Mariposa	6,281	-------	1,946	542	111	826	309	200	-------	-------
Modoc	110	-------	-------	-------	11	9	3	-------	-------	-------
Mono	46	-------	39	1,151	-------	-------	-------	-------	-------	-------
Monterey	1	-------	4	1	-------	-------	-------	-------	-------	-------
Nevada	258,874	-------	[4] 113,546	34,112	5	564	574	-------	900	-------
Placer	732	-------	912	1,283	-------	-------	-------	-------	-------	-------
Plumas	355	-------	32	5	-------	-------	-------	-------	-------	-------
Riverside	2	-------	2	-------	-------	-------	-------	-------	-------	-------
Sacramento	5	-------	30	5	-------	-------	-------	-------	-------	-------
San Bernardino	806	-------	357	1,852	13	13	176	100	3,700	-------
Sierra	29,090	-------	12,820	2,419	55	422	154	-------	-------	-------
Siskiyou	2,567	-------	195	31	-------	-------	-------	-------	-------	-------
Trinity	112	-------	62	17	-------	-------	-------	-------	-------	-------
Tuolumne	406	54	297	24	38	47	27	-------	100	-------
Total: 1949	462,941	2,939	[4] 154,358	[4] 63,148	23,289	7,437	413,509	975,300	10,099,600	12,738,600
1948	486,255	5,150	[4] 126,493	[4] 49,836	22,156	5,449	385,808	688,100	10,946,700	9,748,300
BY CLASSES OF CONCENTRATES										
Dry gold					579	5,875	3,338	600	5,100	-------
Dry silver					1	-------	33	-------	-------	-------
Copper					546	35	21,558	245,700	5,200	-------
Lead					8,952	1,054	287,241	67,200	9,012,400	726,300
Lead-copper					1,873	252	51,223	407,700	494,900	650,400
Zinc					11,338	221	50,116	254,100	582,000	11,361,900
Total 1949					23,289	7,437	413,509	975,300	10,099,600	12,738,600

[1] Figures under "ore" include both raw ore and concentrates produced from that ore, amalgamated or cyanided.
[2] Includes concentrates and gold, silver, and copper from tungsten ore not included with material treated.
[3] Combined to avoid disclosure of individual output.
[4] Includes gold and silver recovered and sold as "natural gold."

Gross metal content of concentrates produced from ores mined in California in 1949, by classes of concentrates

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	579	5,875	3,338	1,154	5,387	66
Dry silver	1	-------	33	-------	-------	-------
Copper	546	35	21,558	250,678	8,706	25,381
Lead	8,952	1,054	287,241	79,286	9,173,319	1,004,719
Lead-copper	1,873	252	51,223	479,622	503,497	898,274
Zinc	11,338	241	53,630	280,588	645,888	11,668,919
Total: 1949	23,289	7,457	417,023	1,091,328	10,336,797	13,597,359
1948	22,156	5,449	385,808	726,419	11,177,277	10,430,305

Gross metal content of California crude ore and old tailings shipped to smelters in 1949, by classes of material

Class of ore	Material shipped		Gross metal content [1]				
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	3,508	10	2,025	6,930	94,021	1,015	252
Dry gold-silver	20	----------	2	104	29	----------	----------
Dry silver	61	----------	----------	3,522	248	394	----------
Copper [1]	250	----------	35	7,766	[2] 148,276	----------	----------
Lead	23,857	----------	2,814	261,214	112,738	10,503,356	1,358,654
Lead-copper	106	----------	2	577	2,918	19,067	----------
Zinc	639	----------	6	20,270	----------	24,303	802,593
Zinc-lead	575	----------	10	2,297	4,789	217,652	110,671
Total: 1949	29,016	10	4,894	302,680	[2] 363,019	10,765,787	2,272,170
1948	29,638	5,733	3,975	267,645	[3] 308,840	7,452,413	1,410,053

[1] Content of copper ore includes silver and copper from pyritic ore (residue) not included with material shipped.
[2] Includes 61,326 pounds contained in precipitates and 2,035 pounds in furnace matte.
[3] Includes 53,072 pounds contained in precipitates.

Mine production of metals from California crude ore and old tailings shipped to smelters in 1949, in terms of recoverable metals

	Material shipped		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
BY COUNTIES							
Amador	20	----------	46	28	----------	----------	----------
Calaveras	11	----------	10	18	----------	----------	----------
Imperial	10	----------	32	9	----------	----------	----------
Inyo	23,078	----------	2,745	257,366	78,500	10,187,500	1,061,100
Kern	20	----------	2	104	----------	----------	----------
Los Angeles	2	----------	13	18	----------	----------	----------
Mariposa	7	----------	5	2	----------	----------	----------
Mono	3	----------	2	14	100	300	----------
Placer	51	----------	34	9	----------	----------	----------
Plumas	1	----------	1	13	[1] 3,500	----------	----------
Riverside	129	----------	45	951	5,100	31,500	----------
San Bernardino [2]	5,559	----------	1,684	24,120	135,400	317,000	618,300
San Diego	3	----------	3	2	----------	----------	----------
Shasta [3]	63	10	226	6,736	[4] 98,500	----------	----------
Siskiyou	44	----------	9	4	1,600	----------	----------
Trinity	7	----------	20	7	----------	----------	----------
Tuolumne	8	----------	11	25	----------	100	----------
Total: 1949	29,016	10	4,888	289,426	322,700	10,536,400	1,679,400
1948	29,638	5,733	3,975	267,645	273,900	7,273,300	901,700
BY CLASSES OF MATERIAL							
Dry gold	3,508	10	2,024	6,930	91,500	700	----------
Dry gold-silver	20	----------	2	104	----------	----------	----------
Dry silver	61	----------	----------	3,451	----------	100	----------
Copper	250	----------	35	7,754	132,400	----------	----------
Lead	23,857	----------	2,814	261,214	92,700	10,290,000	982,100
Lead-copper	106	----------	2	577	2,200	18,500	----------
Zinc	639	----------	1	7,095	----------	13,100	617,200
Zinc-lead	575	----------	10	2,301	3,900	214,000	80,100
Total 1949	29,016	10	4,888	289,426	322,700	10,536,400	1,679,400

[1] Recovered from precipitates.
[2] Content of copper ore from San Bernardino County includes gold, silver, and copper from furnace matte not included with material shipped.
[3] Content of copper ore from Shasta County includes silver and copper from pyritic ore (residue) not included with material shipped.
[4] Includes 56,600 pounds contained in precipitates.

REVIEW BY COUNTIES AND DISTRICTS

AMADOR COUNTY

East Belt District.—Garibaldi Bros. recovered 27 ounces of gold and 3 ounces of silver from 1,100 cubic yards of material handled by drag-line and trommel at the Garibaldi mine from November 15 to December 24, 1949. Logomarsino Bros., lessees, hydraulicked the Union Flat mine from March 1 to May 28, 1949; 2,000 cubic yards of gravel washed yielded 25 ounces of gold and 2 ounces of silver.

Mother Lode District.—Central Eureka Mining Co. worked the Old Eureka mine throughout 1949. Most of the concentrate produced from gold ore treated at the company 150-ton flotation mill was cyanided; a small tonnage was shipped to a smelter. Free gold collected in jigs and bowls was amalgamated.

BUTTE COUNTY

Butte Creek District.—Lancha Plana Gold Dredging Co. operated its Yuba-type bucket-line dredge No. 5 on Butte Creek from January 1 to March 28, 1949.

Oroville District.—Yuba Consolidated Gold Fields, Butte unit, operated two bucket-line dredges throughout the year and one dredge 1½ months of 1949 on land adjoining the Feather River. Gold Hill Dredging Co. operated its electrically powered bucket-line dredge throughout 1949 on the east side of the Feather River 7 miles south of Oroville.

CALAVERAS COUNTY

Campo Seco District.—Penn Chemical Co. operated the Penn mine and 50-ton flotation mill from May 11 to October 31, 1949; 6,639 tons of zinc ore yielded 51 tons of bulk concentrate, containing 6 ounces of gold, 870 ounces of silver, 10,683 pounds of copper, 8,706 pounds of lead, and 25,381 pounds of zinc; 884 tons of zinc concentrate containing 58 ounces of gold, 10,039 ounces of silver, 82,430 pounds of copper, 40,202 pounds of lead, and 816,570 pounds of zinc; and 5 tons of jig concentrate containing 195 ounces of gold, 126 ounces of silver, 193 pounds of copper, 667 pounds of lead, and 66 pounds of zinc. The concentrates were shipped to smelters.

East Belt District—Blackstone Mine (L. A. Sanchez) worked the Blackstone mine and 50-ton mill throughout 1949. Gold and silver were recovered from 1,950 tons of gold ore amalgamated, and 50 tons of flotation and table concentrate shipped to a smelter yielded gold, silver, and some lead. Other lode-gold mines operated during 1949 included the Centennial, Lockwood, Smith, and Soap Root.

Jenny Lind District.—Joe Paltor and others leased the Royal mine from July 1 to December 31, 1949. A substantial quantity of gold and some silver were recovered by amalgamation at the company 10-stamp mill and from flotation concentrate shipped to a smelter.

Mine production of gold, silver, copper, lead, and zinc in California in 1949, by counties and districts, in terms of recoverable metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (lode and placer,[3] fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Amador County:											
Camanche [4]		2			126	126	11				$4,420
East Belt [5]	7	3	514	367	143	510	259				18,085
Ione		2			161	161	22				5,655
Mother Lode [6]	3	4	42,329	18,184	241	18,425	3,920	300	100		648,497
Butte County:											
Butte Creek	(7)	4	Clean-up	1	636	637	57				22,347
Cherokee	1	(7)	60	17	4	21	3				738
Enterprise	1	1	5	1	1	2					70
Forbestown		(7)			5	5					175
Honcut		(7)			31	31	8				1,092
Limpkin		(7)			4	4	1				141
Magalia		(7)			10	10					350
Merrimac		(7)			2	2					70
Oroville		4			22,701	22,701	1,503				795,895
Paradise		(7)			12	12					420
Pulga		(7)			3	3					105
Sterling		(8)			(8)	(8)					(8)
Yankee Hill		(7)			18	18	2				632
Calaveras County:											
Campo Seco	1		6,639	239		239	7,521	76,500	29,900	726,700	125,077
Copperopolis	1		55	12		12	20				438
East Belt [5]	7	(7)	2,428	1,495	60	1,555	970		3,400		55,840
Jenny Lind	2	(7)	2,842	1,093	3	1,096	513				38,824
Mother Lode [6]		3			77	77	4				2,699
West Belt [9]		1			44	44	6				1,545
El Dorado County:											
East Belt [5]	1	3	275	108	17	125	70				4,438
Mother Lode [6]	7	6	14,772	963	1,496	2,459	663				86,665
Pilot Hill		(7)			3	3					105
West Belt [9]		3			527	527	54				18,494
Fresno County: Friant [10]		3			169	169	23				5,936
Humboldt County: Orleans		(8)			(8)	(8)	(8)				(8)
Imperial County: Cargo Muchacho	1		10	32		32	9				1,128
Inyo County:											
Alabama Hills	1		10	3		3					105
Big Pine	1	1	50	2	9	11	371		6,500		1,748
Bishop (Bishop Creek) (Pine Creek)	3		21	34		34	20,716	236,600			66,549
Carbonate	1		9				19		1,500	1,900	490
Cerro Gordo	3		343				2,115	800	92,500	1,600	16,884
Chidago [11]	2		34	14		14	1,068				1,457
Coso	5		62,082	234		234	352,482	115,100	9,856,700	8,123,700	2,914,577

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California in 1949, by counties and districts, in terms of recoverab metals [1]—Continued

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (lode and placer,[3] fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Lode	Placer		Lode	Placer	Total				
Inyo County—Continued										
Deep Springs	3		29	10		10	25		2,000	
Fish Springs	2		243	15		15	17			
Independence	1		501	81		81	10,814	4,700	97,700	
Kearsarge (Waucoba)	3		87	2		2	384	300	17,900	
Modoc	3		5,550	43		43	41,843	4,800	1,457,900	
Resting Springs	2		25,846	3,405		3,405	155,659	57,000	7,898,100	780,400
Slate Range	(5)		(5)	(5)		(5)	(5)	(5)	(5)	(5)
South Park	4		67	23		23	299	100	15,500	11,400
Ubehebe	(5)		(5)	(5)		(5)	(5)	(5)	(5)	(5)
White Mountains	3		35	5		5	621		11,900	
Wild Rose	3		94	72		72	105	500	6,400	
Kern County:										
Bakersfield		1			218	218	55			
Fremont Peak	1		1	1		1				
Green Mountain	2		32	7		7	3			
Keyes (Pioneer)	1	1	215	507	22	529	258			
Mojave	9		8,000	4,689		4,689	17,145			
Randsburg [12]	12	1	1,242	243	27	270	94			
Los Angeles County:										
Cedar	1		64	39		39	9			
Dry Lake	1		5	8		8	2			
Neenach	1		228	45		45	88			
San Gabriel		2			157	157	24			
Madera County:										
Chowchilla River (Raymond) [13]		(5)			(5)	(5)	(5)			
Dennis		3			413	413	117			
Friant [10]		(5)			(5)	(5)	(5)			
Potter Ridge	2	2	70	29	30	59	14			
Mariposa County:										
East Belt [4]	7	3	179	120	15	135	26			
Hunter Valley	3	(5)	5,065	2,230	(5)	2,230	[14] 740	200		
Mother Lode [6]	11	3	1,044	427	264	691	123			
West Belt [9]		(7)			16	16	4			
Merced County:										
Chowchilla River [13]		1			132	132	15			
Snelling		(5)			(5)	(5)	(5)			
Modoc County: Hi Grade	1		110	9		9	3			
Mono County:										
Bodie	(7)		Clean-up	7		7	798			
Chidago [11]	1		3	2		2	14	100	300	
Masonic	(5)		(5)	(5)		(5)	(5)			

Monterey County: Los Burros	(5)		(5)	(5)		(5)				
Nevada County:										
French Corral	1	3	32	7	83	90	11			
Graniteville	1	(7)	94	43	16	59	46			
Grass Valley-Nevada City	7	2	[15] 253,882	[15] 113,134	47	[15] 113,181	[15] 34,451		900	
Washington (North Bloomfield)	3	6	4,866	926	2,199	3,125	453			
You Bet		1			28	28	1			
Placer County:										
Auburn (Penryn)	1	1	701	904	175	1,079	1,311			
Butcher Ranch	1	1	12	4	2	6	2			
Colfax		1			37	37	3			
Dutch Flat		1			80	80	6			
Folsom [10]		1			5	5				
Foresthill	1	4	70	38	49	87	12			
Iowa Hill		2			62	62	7			
Last Chance		1			43	43	3			
Michigan Bluff		1			26	26	3			
Ralston Divide		(5)			(5)	(5)	(5)			
Rocklin		1			5	5				
Plumas County:										
Buttle Valley (Seneca)	1	(7)	15	3	4	7	1			
Edmanton		(5)			(5)	(5)	(5)			
Genesee	2		1	1		1	13	3,500		
Granite Basin	1		7	3		3				
Greenville (Crescent Mills)	1	3	20	7	50	57	7			
La Porte	1	1	210	4	502	506	44			
Quincy		(7)			14	14				
Rich (Virginia)	1	(7)	103	15	42	57	9			
Riverside County:										
Chuckawalla	2		3	2		2	22		1,300	
Eagle Mountain	1		119	43		43	909	4,800	30,200	
Gold Park	1		2				6	300		
Pinacate	1		2	2		2				
Pinion	1		5				14			
Sacramento County:										
Cosumnes River		(5)			(5)	(5)	(5)			
Folsom [16]	1	10	5	30	98,400	98,430	4,568			
San Bernardino County:										
Armagosa	1		6	5		5	4			
Belleville	1		38	19		19	3			
Blackhawk	2		31	64		64				
Buckeye	1		3,253	1,545		1,545	6,600	89,200		
Clark Mountain	4		1,178	70		70	6,485	15,800	272,100	1,100
Coolgardie		(7)			1	1				
Dale	(5)		(5)	(5)		(5)	(5)			
Holcomb	1	1	5		6	6	33			
Ivanpah	2		737	28		28	7,524	17,800	13,100	617,200
Lead Mountain	(5)		(5)	(5)		(5)	(5)	(5)	(5)	
Needles	2		20				558	1,600	600	
Providence	1		14	3		3	2			
Randsburg [12]	2	2	387	233	484	717	153			

See footnotes at end of table.

Stanislaus County:											
Knights Ferry		(7)			1	1					35
La Grange		(8)			(8)	(8)	(8)				(8)
Oakdale		1			19	19	2				667
Trinity County:											
Big Bar		(8)			(8)	(8)	(8)				(8)
Coffee Creek	1	1	1	1	1, 368	1, 369	234				48, 127
Hayfork	3	(7)	92	77	2	79	24				2, 787
Junction City		4			294	294	30				10, 317
Lewiston (Minersville)	1	5	25	3	1, 207	1, 210	108				42, 448
New River		2			6	6					210
Salyer		1			115	115	10				4, 034
Weaverville	1	5	1	1	190	101	9				3, 543
Tulare County: Lemon Cove		1			26	26	4				914
Tuolumne County:											
East Belt [5]	5	(7)	408	75	1	76	56		200		2, 743
Mother Lode [6]	7	1	60	280	16	296	22				10, 380
Yuba County:											
Bear River		(7)			22	22	1				771
Browns Valley	1	1	(15)	(15)	49	49	2				1, 717
Camptonville		4			342	342	46				12, 012
Challenge		(7)			2	2					70
Dobbins		(7)			16	16					560
Smartville		2			455	455	23				15, 946
Strawberry		(7)			2	2					70
Yuba River		(8)			(8)	(8)	(8)				(8)
Other districts [19]	17	24	43, 590	13, 650	107, 551	121, 201	92, 193	655, 800	794, 100	4, 154, 000	5, 095, 228
Total California	242	190	[20] 494, 906	[21] 166, 683	250, 548	[21] 417, 231	[22] 783, 880	[23] 1, 298, 000	20, 636, 000	14, 418, 000	20, 616, 562

[1] Only those districts are shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts are listed in footnote 19 and their output grouped as "Other districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Sources of total silver as follows: 766,083 ounces from lode mines and 17,797 ounces from placer mines.

[4] Camanche district lies in Amador and San Joaquin Counties.

[5] East Belt district lies in Amador, Calaveras, El Dorado, Mariposa, and Tuolumne Counties.

[6] Mother Lode district lies in Amador, Calaveras, El Dorado, Mariposa, and Tuolumne Counties.

[7] From property not classed as a mine.

[8] Included with "Other districts."

[9] West Belt district lies in Calaveras, El Dorado, and Mariposa Counties.

[10] Friant district lies in Fresno and Madera Counties.

[11] Chidago district lies in Inyo and Mono Counties.

[12] Randsburg district lies in Kern and San Bernardino Counties.

[13] Chowchilla River district lies in Madera and Merced Counties.

[14] Exclusive of placer output which is included with "Other districts."

[15] Includes Browns Valley district (lode), Yuba County.

[16] Folsom district lies in Placer and Sacramento Counties.

[17] Exclusive of lode output which is included with "Other districts."

[18] Combined with Grass Valley-Nevada City district (lode) in Nevada County to avoid disclosure of individual output.

[19] Includes following: Sterling district (placer) in Butte County; Orleans (placer) in Humboldt County; Slate Range (lode) and Ubehebe (lode) in Inyo County; Chowchilla River (Raymond) [13] (placer) and Friant [10] (placer) in Madera County; Hunter Valley (placer) in Mariposa County; Snelling (placer) in Merced County; Los Burros (lode) in Monterey County; Masonic (lode) in Mono County; Ralston Divide (placer) in Placer County; Edmanton (placer) in Plumas County; Cow Creek (lode), Flat Creek (lode), Redding (placer), and Shasta (lode) in Shasta County; Alleghany (lode) and Downieville (lode) in Sierra County; Callahan (placer) in Siskiyou County; La Grange (placer) in Stanislaus County; Big Bar (placer) in Trinity County; and Yuba River (placer) in Yuba County.

[20] Excludes tungsten ore.

[21] Includes metal recovered from tungsten ore.

[22] Includes metal recovered from tungsten ore and pyritic ore (residue).

[23] Includes metal recovered from tungsten ore and pyritic ore (residue); also includes 60,100 pounds contained in precipitates and 2,000 pounds in furnace matte.

Mine production of gold, silver, copper, lead, and zinc in California in 1949, by counties and districts, in terms of recoverable metals [1]—Continued

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (lode and placer,[3] fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
San Bernardino County—Continued											
Silurian	1		86				3,718		100		$3,381
Silver Mountain	1		1				14				13
Soda Lake	8		171	25		25	743	6,600	21,100		6,181
Summit Valley		[7]			5	5					175
Twentynine Palms	2		51	6		6	134	100	3,700		935
Whipple Mountain	5		100	25		25	9	3,900	300		1,698
San Diego County: Campo	1		3	3		3	2				107
San Francisco County: San Francisco (Beach)		1			3	3	1				106
San Joaquin County: Camanche [4]		[8]			[8]	[8]	[8]				[8]
Shasta County:											
Battle Creek		[7]			28	28	6				985
Cottonwood Creek		[7]			28	28	2				982
Cow Creek	[8]		[8]	[8]		[8]	[8]	[8]	[8]	[8]	[8]
Dog Creek		[7]			3	3					105
Flat Creek	[8]		[8]	[8]		[8]	[8]	[8]			[8]
French Gulch	2	1	10	6	23	29	4				1,019
Harrison Gulch		[7]			1	1					35
Igo	4		70	224		224	228				8,046
Redding	3	[8]	70	14	[8]	14	[14] 6				[14] 495
Shasta	[8]	[7]	[8]		112	112	[17] 18				[14] 3,936
Sunny Hill		1			2	2					70
Sierra County:											
Alleghany	[8]	5	[8]	[8]	145	145	[17] 22				[17] 5,095
Downieville	[8]	6	[8]	[8]	65	65	[17] 6				[17] 2,280
Indian Hill		1			6	6					210
Pike	1	[7]	650	138	21	159	48				5,609
Poker Flat		1			9	9					315
Port Wine		[7]			7	7					245
Sierra City		2			5	5	1				176
Siskiyou County:											
Callahan		[8]			[8]	[8]	[8]				[8]
Cottonwood	3		16	17		17	3				598
Deadwood		2			5,551	5,551	781				194,991
Gazelle	1	[7]	43		4	4		1,600			455
Humbug	3	1	46	57	24	81	13				2,847
Klamath River		4			2,584	2,584	334				90,742
Liberty	1	10	2,000	18	132	150	27				5,275
Salmon River		[7]			20	20	1				701
Scott Bar	1	1	500	11	3	14	1				491
Yreka	2	2	6	101	16	117	21				4,114

EL DORADO COUNTY

East Belt District.—Cosumnes Mines, Inc., developed the Cosumnes mine from April 1 to December 31, 1949. Most of the concentrate produced from 275 tons of gold ore milled at its 60-ton flotation mill was cyanided at a custom mill; some concentrate was shipped to a smelter.

Mother Lode District.—Lord & Bishop operated a dragline and fuel-oil-powered Bodinson floating washing plant on Greenwood Creek in December 1949; 106 ounces of gold and 13 ounces of silver were recovered from 14,000 cubic yards of gravel washed on the David property. E. B. Matherly worked his suction dredge 820 hours during 1949 on the American River and recovered 84 ounces of gold from 5,200 cubic yards of gravel. River Pine Mining Co., Ltd., operated a dragline dredge on the Middle Fork of the Cosumnes River from August 23 to December 31, 1949; Twin Forks Dredging Co. operated similar equipment on the North Fork of the Cosumnes River from June through December 1949. Volo Mining Co. worked the Shaw mine in 1949, recovering gold and silver from ore amalgamated at the company mill. In addition, flotation concentrates were shipped to a custom-cyanide mill and to a smelter.

West Belt District.—Lord & Bishop operated a dragline and Bodinson washing plant on Carson Creek from January 15 to April 15, 1949; 71,000 cubic yards of gravel treated yielded 458 ounces of gold and 48 ounces of silver.

FRESNO COUNTY

Friant District.—Pacific Coast Aggregates, Inc., recovered gold and some silver incident to operation of its Rockfield commercial rock and gravel plant.

HUMBOLDT COUNTY

Orleans District.—Pearch Mining Co., hydraulicked the Pearch mine from February 1 to June 15, 1949; Fred Ray and Luthena White purchased the lease October 20, 1949.

INYO COUNTY

Bishop (Bishop Creek) (Pine Creek) District.—The United States Vanadium Corp. worked the Pine Creek mine throughout 1949 and produced by flotation a copper concentrate (containing a substantial quantity of silver and some gold) as a byproduct from ore treated primarily for tungsten.

Cerro Gordo District.—Sierra Ventura Mines, Inc., worked the Ventura mine from February 4 to August 1, 1949; 21 tons of screenings with a gross metal content of 26 ounces of silver, 42 pounds of copper, 2,293 pounds of lead, and 2,038 pounds of zinc were shipped to a concentrator-smelter. Santa Rosa Mining Co. operated the Santa Rosa mine during 1949 and shipped lead ore to a smelter.

Coso District.—Joe McCulley developed the Empress group throughout 1949; 91 tons of ore containing 1 ounce of gold, 726 ounces of silver, 3,699 pounds of copper, 39,329 pounds of lead, and 12,388 pounds of zinc were shipped to a smelter. Anaconda Copper Mining Co.

worked the Darwin group of mines (the largest producer of silver, lead, and zinc in California) from January 1 through June 18, 1949. Operations were resumed September 16 and continued until the end of the year. The lead concentrate and zinc concentrate produced from the zinc-lead sulfide ore treated at the company 300-ton flotation mill were shipped to smelters. In addition, lead ore was shipped for direct smelting. Frank & Weslyn Wiece, Jack Hoppe, and Bert Quinn worked the Silverspoon mine during 1949; 158 tons of zinc-lead ore (containing 2 ounces of gold, 397 ounces of silver, 403 pounds of copper, 56,319 pounds of lead, and 28,124 pounds of zinc) and 37 tons of lead ore (containing 143 ounces of silver and 8,487 pounds of lead) were shipped to smelters.

Kearsarge (Waucoba) District.—W. Denman & E. Carlson worked the Nancy Hanks mine for 3 months in 1949; 27 tons of lead ore shipped to a smelter contained 233 ounces of silver, 12 pounds of copper, and 13,961 pounds of lead.

Modoc District.—Finley & Vignich worked the Minnietta mine throughout 1949; 861 tons of lead ore shipped for direct smelting contained 5 ounces of gold, 4,483 ounces of silver, 405 pounds of copper, and 382,386 pounds of lead. In addition, 13 tons of table concentrate (containing 1 ounce of gold, 749 ounces of silver, 30 pounds of copper, and 8,387 pounds of lead) produced from tailings were shipped to a smelter. Foreman & Skinner operated the Defense mine from January to July 1949. Lead ore containing a substantial quantity of silver and some gold and copper was shipped to a smelter.

Resting Springs District.—Anaconda Copper Mining Co. operated the Shoshone group of mines (second-largest producer of silver and lead in the State) throughout 1949. Sulfide flotation of the lead ore followed by flotation of oxidized lead minerals yielded a lead concentrate containing some gold, silver, copper, and zinc. The concentrate and lead ore (containing substantial quantities of gold and silver and some copper and zinc) were shipped to a smelter.

South Park District.—Harry E. Briggs shipped 34 tons of zinc-lead ore containing 3 ounces of gold, 159 ounces of silver, 137 pounds of copper, 12,860 pounds of lead, and 15,732 pounds of zinc to a smelter from the Red Cloud mine during 1949.

Ubehebe District.—George Lippincott worked the Lippincott mine throughout 1949. In addition to zinc-lead ore shipped to smelter, 400 tons of lead ore were consigned to the Lippincott blast furnace at Santa Ana, Calif., for treatment. Ubehebe Mines, Inc., worked the Ubehebe mine from January to May 2, 1949; 99 tons of ore shipped to a smelter contained 2 ounces of gold, 311 ounces of silver, 277 pounds of copper, 39,652 pounds of lead, and 11,568 pounds of zinc.

White Mountains District.—Grandview Mining Co. worked the Buster group from April 15 to September 15, 1949; 17 tons of ore containing 125 ounces of silver, 34 pounds of copper, and 2,570 pounds of lead were shipped to a smelter.

KERN COUNTY

Bakersfield District.—C. & H. Materials Co. recovered gold and silver as byproducts from its commercial rock plant on the Kern River.

Mojave District.—Burton Bros., Inc., operated its cyanide mill throughout 1949 on ore from the Cactus Queen, Tropico (Kid, Trailer Wheel), and Middle Buttes mines and, in addition, treated ores from other mines in the Mojave district (including the Standard, Whitmore, Elephant-Eagle, Red Mill No. 2, and Silver King).

Randsburg District.—Butte Lode Mining Co. operated the Butte Lode mine throughout 1949; 505 tons of ore amalgamated at the company mill yielded 81 ounces of gold and 22 ounces of silver. The mill also handled custom ore from neighboring mines, including the Minnesota, Josephine, Hercules, California, and Big Dyke. Mason, Hager & Cole operated a dry-land dredge at the Goler mine from January 10 to February 14; 25 ounces of gold and 4 ounces of silver were recovered from 20,000 cubic yards of gravel.

LOS ANGELES COUNTY

Neenach District.—Antelope Mining Corp. worked the Rogers & Gentry mine from September 28 to November 26, 1949; gold and silver were recovered from 228 tons of ore (some concentrated at the company mill and smelted, and the balance was amalgamated and cyanided at custom mills).

San Gabriel District.—San Gabriel Valley Placers (Robert A. Riggs) recovered 71 ounces of gold and 11 ounces of silver as byproducts of the Azusa Rock & Sand Co. plant.

MADERA COUNTY

Chowchilla River (Raymond) District.—Howell Bros. operated a suction dredge intermittently during 1949 and recovered a substantial quantity of gold and some silver.

Potter Ridge District.—F. Gilman Low and Michael Salonish operated the New Deal mine throughout 1949; 60 tons of ore amalgamated yielded 28 ounces of gold and 6 ounces of silver. Robert C. Jordan dredged the Emerick and Parker properties in 1949, using a suction dredge.

MARIPOSA COUNTY

East Belt District.—J. H. Metzler shipped 4 tons of gold ore containing 3 ounces of gold and 1 ounce of silver to a smelter in 1949 from the Blue Ribbon mine. Other gold mines that operated during the year were: Mexican Diggings (R. H. Jackson), Nutmeg and Permit (Permit Mining Corp.), and Schroeder mine (Schroeder Mines).

Hunter Valley District.—Mount Gaines Mining Co. worked the Mount Gaines mine from January 1 to September 30, 1949, and amalgamated 5,020 tons of gold ore, from which was recovered bullion (containing 1,397 ounces of gold and 430 ounces of silver) and 111 tons of flotation and table concentrate containing 826 ounces of gold and 309 ounces of silver. Thurman & Wright operated its dragline dredge No. 3 on Burns Creek from February 10 to August 6, 1949.

Mother Lode District.—James H. Henry dredged on Bear Creek from January 23 to May 22, 1949, and operated a Diesel-powered dragline and a Henry floating washing plant; 238 ounces of gold and 28 ounces of silver were recovered from 32,335 cubic yards of gravel. Gold ore

from a number of mines worked during 1949 (including the Argo, Combination, Diltz-Oro Grande, Lonesome Pine, Malone, Specimen, and Texas Gulch) was treated by amalgamation.

MERCED COUNTY

Snelling District.—Merced Dredging Co. operated its bucket-line Dredge No. 1 from January 1 until April 17, 1949, when the operation was shut down and the dredge dismantled. Snelling Gold Dredging Co. worked two bucket-line dredges (one the entire year and the other from January 1 to October 10, 1949) adjacent to the Merced River between Snelling and Merced Falls.

MONO COUNTY

Masonic District.—Sarita Mines, Inc., shipped gold ore, with values in silver, from the Sarita mine to a custom-cyanide mill in Nevada during 1949.

NEVADA COUNTY

Graniteville District.—R. Moore and Ed Dunbar worked the 4 D's mine from June 21 to October 7, 1949; 10 tons of ore amalgamated yielded 20 ounces of gold and 21 ounces of silver and 84 tons of gold ore cyanided at a custom mill yielded 23 ounces of gold and 22 ounces of silver.

Grass Valley-Nevada City District.—The Empire Star Mines Co., Ltd., treated ore from the Empire, North Star, and Pennsylvania mines at Grass Valley and the company Browns Valley properties in Yuba County by amalgamation and cyanidation; ore and concentrates from several neighboring properties also were treated at the 500-ton mill and cyanide plant. Idaho-Maryland Mines Corp. worked the Idaho and Brunswick units throughout 1949, treating gold ore by amalgamation followed by cyanidation of concentrates. Stockton Hill mine shipped 867 tons of ore containing 261 ounces of gold to a custom cyanide mill from the Stockton Hill mine in 1949.

Washington (North Bloomfield) District.—Dallas Church worked the Washington Creek (Giant King) mine in 1949 and trucked 221 tons of gold ore containing 29 ounces of gold and 53 ounces of silver to a custom-cyanide mill. Ancho Erie Mining Co. developed the Ancho and Erie groups throughout 1949, treating gold ore in its 200-ton concentrating mill and 6-ton cyanide plant. A. P. Landsburg and Joe Swazey hydraulicked the Relief Hill mine and recovered 120 ounces of gold and 5 ounces of silver from 10,000 cubic yards of gravel. Frank Mellott and associates hydraulicked the Waukashau mine; 116 ounces of gold and 5 ounces of silver were recovered from 6,000 cubic yards of gravel. Goldfield Consolidated Mines Co. hydraulicked the Omega mine, and Crescent Pacific Mining Co. worked the Eastman placer mine during 1949.

PLACER COUNTY

Auburn (Penryn) District.—Mary Len Mine (a partnership) worked the Mary Len mine in 1949; gold ore was amalgamated at the company mill and concentrate shipped to a custom-cyanide plant. Schwartz

& Mitchell operated dragline equipment and a washing plant in Auburn Ravine during 1949.

PLUMAS COUNTY

La Porte District.—R. & M. Mining Co. operated a dragline and Bodinson washing plant on Slate Creek from May to November 1949.

Rich (Virgilia) District.—R. S. Crozen worked the Klau Mines, Inc., Virgilia mine intermittently in 1949; 103 tons of ore amalgamated yielded 15 ounces of gold and 3 ounces of silver.

RIVERSIDE COUNTY

Eagle Mountain District.—Eagle Lead Co. shipped lead ore containing some gold, silver, and copper from the Black Eagle mine to a smelter in 1949.

SACRAMENTO COUNTY

Cosumnes River District.—Mountain Gold Dredging Co. operated a Diesel dragline dredge at Michigan Bar throughout 1949. Cosumnes Gold Dredging Co. operated its bucket-line dredge near Sloughhouse during 1949.

Folsom District.—The Natomas Co., leading California gold producer in 1949, operated seven Natomas-type bucket-line dredges (five units the full year, one unit 9 months, and one unit 2 months) during 1949 on property near the American River. Capital Dredging Co. worked bucket-line dredges No. 3 and No. 4 respectively 12 and 7½ months in 1949, 5 miles south of Folsom. General Dredging Co. operated a Diesel dragline and electric-powered washing plant at Natoma throughout 1949. Lancha Plana Gold Dredging Co. operated bucket-line dredge No. 4 on the American River from January 1 to April 8, 1949. The Fair Oaks Gravel Co. recovered as a byproduct of gravel-washing operations 135 ounces of gold and 9 ounces of silver from 51,296 cubic yards of material handled.

SAN BERNARDINO COUNTY

Buckeye District.—Donald F. Love shipped gold ore from the Roosevelt-Bagdad Chase mine to a smelter in 1949; substantial quantities of gold, silver, and copper were recovered.

Clark Mountain District.—Robert H. Cordill worked the H & H claims from April 28 to July 11, 1949; 5 tons of ore shipped to a smelter contained a trace of gold, 231 ounces of silver, and 68 pounds of copper. Mohawk Mines, Inc., worked the Mohawk mine, and Altana Corp. operated the Wilshire mine of the Mohawk group in 1949; lead ore was shipped to smelters.

Ivanpah District.—New Trail Mining Co. and its successor, Alloy Mining Co., operated the New Trail mine intermittently in 1949; 98 tons of ore shipped to a smelter contained 27 ounces of gold, 429 ounces of silver, and 18,130 pounds of copper. The Carbonate King zinc mine was worked by J. Q. Little under contract from the Crystal Cave Mining Co.; zinc ore containing some gold, silver, and lead was shipped to a smelter.

Randsburg District.—Baird, Martin, Ralston & Ralston worked the Pioneer group from March 1 to December 31, 1949; 387 tons of ore

amalgamated at a custom mill yielded 225 ounces of gold and 61 ounces of silver. Surcease Mining Co. recovered 317 ounces of gold and 63 ounces of silver from 10,543 cubic yards of gravel at the Super Mold property in 1949 by dry-land dredging; in addition, gravel handled chiefly for scheelite at the Spud Patch mine yielded 157 ounces of gold and 24 ounces of silver.

SAN JOAQUIN COUNTY

Camanche District.—The Gold Hill Dredging Co. operated its Lower Comanche bucket-line dredge from January 8 to December 31 and its Upper Comanche dredge from January 1 to January 26, 1949, along the Mokelumne River.

SHASTA COUNTY

Cow Creek District.—The Coronado Copper & Zinc Co., second largest producer of zinc in the State, worked the Afterthought mine from January 1 to June 30, 1949. Zinc concentrate and lead-copper concentrate produced from the zinc ore milled at the company 100-ton plant were shipped to smelters.

Redding District.—Thurman Gold Dredging Co. operated its Yuba-type bucket-line dredge on Clear Creek throughout 1949.

SIERRA COUNTY

Alleghany District.—John O'Donnell worked the Kate Hardy mine in 1949 and recovered 729 fine ounces of gold and 163 fine ounces of silver from 1 ton of high-grade ore. The Original Sixteen to One Mine, Inc., operated its Original Sixteen to One mine throughout 1949, recovering gold and some silver by amalgamation and from gold concentrate shipped to a smelter.

Downieville District.—Brush Creek Mine and Alfred L. Merritt operated the Brush Creek mine in 1949 and recovered a substantial quantity of gold and some silver by amalgamation and from concentrate cyanided at a custom mill. The company mill was destroyed by fire late in December 1949.

SISKIYOU COUNTY

Callahan District.—Yuba Consolidated Gold Fields (Siskiyou unit) operated its Callahan dredge (equipped with 72 9-cubic-foot buckets) throughout 1949 on Scott River.

Deadwood District.—French Gulch Dredging Co. worked its bucket-line dredge on Indian Creek throughout 1949; 5,390 ounces of gold and 755 ounces of silver were recovered from 1,266,243 cubic yards of gravel handled.

Klamath River District.—Reeves Ranch Dredging Co. operated a bucket-line dredge on the Klamath River 1 mile from Happy Camp throughout 1949.

Liberty District.—E. A. McBroom hydraulicked the Farnsworth mine from March throughout June 1949; 2,520 cubic yards of gravel washed yielded 12 ounces of gold and 2 ounces of silver. Other mines hydraulicked in 1949 included the Boulder Gulch group, Emma and Ray groups, Joubert, Webb, and Judge.

STANISLAUS COUNTY

La Grange District.—La Grange Gold Dredging Co. worked its bucket-line dredge No. 4 on the Tuolumne River bottom throughout 1949. Tuolumne Gold Dredging Co. operated a bucket-line dredge for a short period in 1949 but closed down the operation February 14.

TRINITY COUNTY

Coffee Creek District.—Mires & Garner operated the Mires & Underseth bucket-line dredge in 1949.

Hayfork District.—T. C. Kelly worked the Kelly mine 7 months in 1949; gold and silver were recovered by amalgamating the high-grade ore and from ore shipped to a smelter.

Junction City District.—Julian I. Collicott and Elmer Katt recovered 6 ounces of gold and 1 ounce of silver from 500 cubic yards of gravel hydraulicked at the Carr mine. The Goldfield Consolidated Mines Co. and Gilzean Bros., lessees, hydraulicked the Red Hill property throughout 1949.

Lewiston (Minersville) District.—Fairview Placers operated the former Junction City dredge, Yuba-type, electrically powered, equipped with 70 10½-cubic-foot buckets, on Stuart Forks and Trinity River from September 26 to December 31, 1949.

Weaverville District.—Perry T. Bennett hydraulicked the Rex mine during 1949. Other placer properties worked during the year included: Aurora (Robert A. Hall), Brown's Creek (C. O. Arbuckle), and Buckeye Creek and Indian Creek (Terminal Truck Service).

TULARE COUNTY

Lemon Cove District.—Terminus Beach Rock Co., Inc., recovered 26 ounces of gold and 4 ounces of silver from 310,000 cubic yards of material handled at its commercial gravel plant on Kaweah River.

TUOLUMNE COUNTY

East Belt District.—George A. & John W. Miller worked the Golden Star mine from April 1 to June 1, 1949; 5 tons of concentrate smelted (produced from approximately 54 tons of tailings) yielded 7 ounces of gold and 3 ounces of silver. Other mines operated in the district on a small scale during 1949 included: Eureka, Grizzly, Longfellow, and Two Bettys.

Mother Lode District.—Pocket mines that produced gold during 1949, included: Ford (Ralph & Jo Tapley); Farrington (Frank Jancygay); Hidden Treasure (Harry Gibson & H. C. Keenan); and Lucky Strike (E. H. Crabtree and J. P. Katsulakis).

YUBA COUNTY

Browns Valley District.—Empire Star Mines Co., Ltd., and lessees worked the Dannebroge mine during 1949 in conjunction with the company's Nevada County properties.

Yuba River District.—Yuba Consolidated Gold Fields (Yuba unit) operated its fleet of five Yuba-type dredges (all equipped with 18-cubic-foot buckets) on the Yuba River Basin throughout 1949.

Colorado

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. Martin

GENERAL SUMMARY

COLORADO'S output of lead and zinc established long-time records in 1949 despite sharp declines in base-metal prices that caused one of the large producers and a number of small-scale operations to shut down before midyear. The production of lead increased 7 percent and of zinc 6 percent in quantity over 1948, making the lead output the highest since 1927 and zinc since 1917. San Miguel and Mineral Counties showed the largest percentage gains among the important-producing counties; Eagle, Lake, and Ouray Counties recorded moderate gains in both lead and zinc and San Juan County in lead. The only large decreases were in Dolores and Gunnison Counties; Summit County had small percentage declines in both metals and San Juan County in zinc. The State production of copper, nearly all derived from ores yielding chiefly lead, zinc, and precious metals, increased 4 percent.

Gold production decreased 34 percent from 1948. Virtually all mining operations in the famous Cripple Creek district shut down in February to await completion of a new custom mill being built there to replace the Golden Cycle mill at Colorado Springs as a market for Cripple Creek ore. Other gold districts either remained inactive or had a low production, and gold output decreased in most of the principal districts producing gold along with silver and base metals. The State silver production decreased slightly and amounted to about half the annual average for the 10-year prewar period 1932–41.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold[1] (per fine ounce)	Silver[2] (per fine ounce)	Copper[3] (per pound)	Lead[3] (per pound)	Zinc[3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Colorado, 1945–49, and total, 1858–1949, in terms of recoverable metals

Year	Mines producing		Ore sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	195	41	1,357,551	110,935	$3,532,725	2,226,780	$1,583,488
1946	235	28	1,463,496	142,613	4,991,455	2,240,151	1,810,042
1947	290	33	1,544,694	168,279	5,889,765	2,557,653	2,314,676
1948	271	23	1,438,119	154,802	5,418,070	3,011,011	2,725,117
1949	255	27	1,262,355	102,618	3,591,630	2,894,886	2,620,018
1858–1949			(1)	39,483,642	875,804,434	738,890,228	575,229,936

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	1,485	$400,950	17,044	$2,931,568	35,773	$8,227,790	$16,676,521
1946	1,754	568,296	17,036	3,713,848	36,147	8,819,868	19,903,509
1947	2,150	903,000	18,696	5,384,448	38,745	9,376,290	23,868,179
1948	2,298	997,332	25,143	9,001,194	45,164	12,013,624	30,155,337
1949	2,403	946,782	26,853	8,485,548	47,703	11,830,344	27,474,322
1858–1949	257,562	69,132,483	2,532,574	261,783,053	1,470,810	236,480,646	2,018,430,552

[1] Figure not available.

Gold and silver produced at placer mines in Colorado, 1945–49, in fine ounces in terms of recoverable metals

Year	Small-scale hand methods [1]		Hydraulic		Gravel mechanically handled: Nonfloating washing plants [2]		Gravel mechanically handled: Bucket-line and drag-line dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1945	147	35	49	11	409	72	7,296	1,277	7,901	1,395
1946	89	15			1,047	169	19,036	3,514	20,172	3,698
1947	243	52			930	156	16,400	3,243	17,573	3,451
1948	106	29			662	103	12,479	2,680	13,247	2,812
1949	137	33			775	116	12,231	2,652	13,143	2,801

[1] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.
[2] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

Gold.—The Colorado output of gold in 1949 was 102,618 fine ounces—a decrease of 52,184 ounces from 1948. The largest decrease was 40,109 ounces in the Cripple Creek district, where nearly all mining was suspended when the Golden Cycle mill at Colorado Springs closed February 20. Mining will be resumed when the new custom mill, under construction at Cripple Creek, is ready to receive ore. The Upper San Miguel district ranked first in gold production, California (Leadville) second, and Cripple Creek third. Dry gold and silver ores yielded 51 percent of the State total gold, zinc-lead and zinc-lead-copper ores 31 percent, placers 13 percent, and other ores 5 percent. The leading gold-producing properties, in order of rank, were: Smug-

gler Union group (Telluride Mines) at Telluride, Treasury Tunnel-Black Bear (Idarado) in San Miguel County, Resurrection at Leadville, Shenandoah-Dives near Silverton, and South Platte Dredging Co. dredge near Fairplay.

Silver.—Production of silver in Colorado in 1949 (2,894,886 fine ounces) decreased 4 percent from 1948. Zinc-lead and zinc-lead-copper ores yielded 44 percent of the State total silver in 1949, dry gold and silver ores 41 percent, and other ores and placer gravel 15 percent. The leading producers of silver were the Treasury Tunnel-Black Bear (Idarado) group in San Miguel County, Shenandoah-Dives group near Silverton, Emperius Mining Co. group at Creede, American Smelting & Refining Co. Kokomo unit (Victory group), and Eagle mine at Gilman.

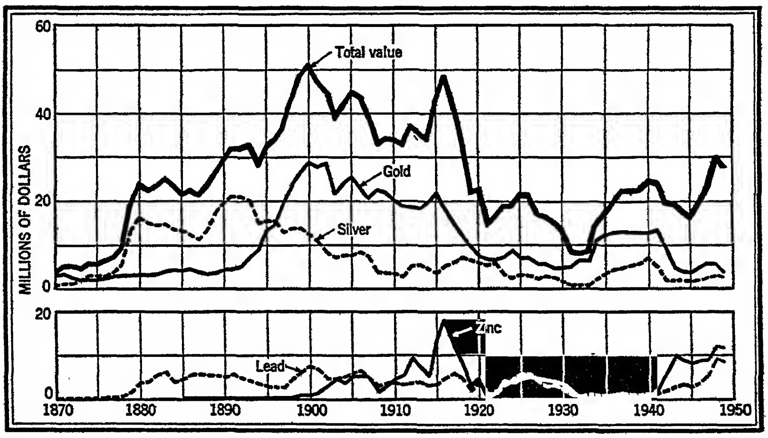

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Colorado, 1870–1949. The value of copper has been less than $2,000,000 annually, except in a few years.

Copper.—Copper ore yielded only 5 percent of the State output of copper in 1949; the rest was recovered from ores yielding chiefly zinc, lead, or precious metals. The Idarado Mining Co., which makes a copper concentrate from complex gold-silver-copper-lead-zinc ore mined in San Miguel County, was the only substantial Colorado producer of copper.

Lead.—Although the sharp drop in the price of lead caused some Colorado mines to close in 1949, the State output of lead increased for the third successive year and was the highest since 1927. The quantity produced was 26,853 tons compared with 25,143 tons in 1948. San Miguel County contributed 20 percent of the State total lead, Lake County 19 percent, Summit 16 percent, San Juan 13 percent, Eagle 6 percent, Ouray 6 percent, and other counties 20 percent. Zinc-lead and zinc-lead-copper ores yielded more than 64 percent of the total lead, gold and silver ores 20 percent, lead ore 9 percent, and copper, lead-copper, and zinc ores nearly 7 percent. The larger lead-producing mines, in order of rank, were: Victory group at Kokomo (American Smelting & Refining Co.), Resurrection at Leadville, Treasury

Tunnel-Black Bear (Idarado) in San Miguel County, Smuggler Union at Telluride, and Eagle mine at Red Cliff.

Zinc.—The production of zinc in Colorado held at a fairly steady monthly rate throughout 1949 and totaled 47,703 tons (recoverable metal) compared with 45,164 tons in 1948. All the leading zinc producers that were active in 1948 except the Rico Argentine mine in Dolores County operated all of 1949, but a number of the smaller mines closed after the price of zinc began to decline in March. Eagle County produced more than 36 percent of the State total zinc in 1949, Summit County 21 percent, Lake more than 13 percent, San Miguel nearly 13 percent, and other counties 17 percent. Zinc and zinc-lead-copper ores yielded 94 percent of the State total zinc. The leading zinc-producing mines, in order of rank, were: Eagle mine at Gilman, American Smelting & Refining Co. Kokomo unit, Treasury Tunnel-Black Bear (Idarado) in San Miguel County, Resurrection group at Leadville, and Smuggler Union (Telluride mines) at Telluride.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1949, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Adams		4	775	$27,125	116	$105
Boulder	12	1	2,195	76,825	78,245	70,816
Chaffee	8	2	103	3,605	3,572	3,233
Clear Creek	33	2	3,071	107,485	86,289	78,096
Custer	4		19	665	16,061	14,536
Dolores	6		79	2,765	80,032	72,433
Eagle	4		766	26,810	216,589	196,024
Fremont	1		20	700	31	28
Gilpin	9	6	135	4,725	610	552
Gunnison	5		64	2,240	60,147	54,436
Hinsdale	12		23	805	3,339	3,022
Jefferson		3	32	1,120	9	8
Lake	25	1	17,996	629,860	223,190	201,998
La Plata	5		217	7,595	2,286	2,069
Mineral	6		779	27,265	263,867	238,813
Montezuma	1		16	560	73	66
Montrose		1	1	35		
Ouray	19		2,824	98,840	206,667	187,044
Park	7	4	10,205	357,175	14,829	13,421
Pitkin	3				32,692	29,588
Rio Grande	1		82	2,870	201	182
Saguache	11		98	3,430	21,970	19,884
San Juan	31		11,549	404,215	584,068	528,611
San Miguel	7	2	35,789	1,252,615	655,646	593,393
Summit	32	1	2,320	81,200	341,368	308,955
Teller	13		13,460	471,100	2,989	2,705
Total: 1949	255	27	102,618	3,591,630	2,894,886	2,620,018
1948	271	23	154,802	5,418,070	3,011,011	2,725,117

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1949, by counties, in terms of recoverable metals—Continued

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Adams							$27,230
Boulder	8	$3,152	120	$37,920			188,713
Chaffee			48	15,168	12	$2,976	24,982
Clear Creek	17	6,698	746	235,736	416	103,168	531,183
Custer			52	16,432	34	8,432	40,065
Dolores	33	13,002	1,388	438,608	1,354	335,792	862,600
Eagle	202	79,588	1,600	505,600	17,450	4,327,600	5,135,622
Fremont							728
Gilpin			9	2,844			8,121
Gunnison	17	6,698	1,293	408,588	1,504	372,992	844,954
Hinsdale	4	1,576	49	15,484	15	3,720	24,607
Jefferson							1,128
Lake	115	45,310	5,080	1,605,280	6,455	1,600,840	4,083,288
La Plata							9,664
Mineral	37	14,578	1,162	367,192	671	166,408	814,256
Montezuma							626
Montrose							35
Ouray	173	68,162	1,521	480,636	1,374	340,752	1,175,434
Park	3	1,182	119	37,604	253	62,744	472,126
Pitkin			82	25,912	49	12,152	67,652
Rio Grande	2	788					3,840
Saguache	21	8,274	319	100,804	369	91,512	223,904
San Juan	304	119,776	3,513	1,110,108	1,599	396,552	2,559,262
San Miguel	1,400	551,600	5,414	1,710,824	6,004	1,488,992	5,597,424
Summit	67	26,398	4,338	1,370,808	10,144	2,515,712	4,303,073
Teller							473,805
Total: 1949	2,403	946,782	26,853	8,485,548	47,703	11,830,344	27,474,322
1948	2,298	997,332	25,143	9,001,194	45,164	12,013,624	30,155,337

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	10,110	204,373	164	2,035	3,139
February	7,698	178,750	150	1,907	3,918
March	8,531	225,200	205	2,211	4,496
April	6,598	217,420	148	2,316	3,985
May	7,444	225,632	205	2,227	3,995
June	8,300	228,425	186	2,055	3,987
July	7,684	249,990	213	2,199	3,710
August	9,473	316,180	266	2,584	4,425
September	10,993	294,904	225	2,482	3,960
October	8,218	251,200	216	2,231	3,900
November	8,848	251,650	210	2,306	4,220
December	8,721	251,162	215	2,300	3,968
Total: 1949	102,618	2,894,886	2,403	26,853	47,703
1948	154,802	3,011,011	2,298	25,143	45,164

MINING INDUSTRY

The quantity of dry gold and silver ores mined in Colorado in 1949 decreased 26 percent from 1948. The mines of the Cripple Creek district shut down when the Golden Cycle mill at Colorado Springs closed in February 1949 and are expected to remain idle until the new Carlton custom mill under construction in the Cripple Creek district is completed and put in operation. Other gold districts either remained idle or had low outputs. About the same quantity of combined lead, zinc, copper, and complex gold-silver-copper-lead-zinc ores were mined as in 1948. The sharp declines in prices of copper, lead, and zinc caused one of the larger producers and a number of small-scale operations to close, but some of the larger producers expanded operations as metal prices declined in order to reduce the cost per ton of ore mined. The 6-day workweek was continued by most of the principal producers. Considerable exploration by diamond drilling, crosscutting, and drifting was carried on by the mining companies in the Aspen, Leadville, and Kokomo (Ten Mile) districts and the San Juan region. The Bureau of Mines did exploratory drilling in Pitkin and San Juan Counties and prepared to resume work on driving the Leadville drainage tunnel begun during the war. Data on the mineral deposits and mining and milling methods in the San Juan region were published.[1] The only important placer operations were the bucket-line dredge in Park County and the two drag-line dredges on the Mount Elbert placers in Lake County.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ores sold or treated in Colorado in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold ore	55	215,357	39,479	177,222	216,237	4,632,815	3,368,962
Dry gold-silver ore	21	224,999	12,027	554,833	402,284	3,217,589	850,819
Dry silver ore	28	66,518	1,110	445,208	205,597	2,765,405	1,500,723
Total	104	506,874	52,616	1,177,263	824,118	10,615,809	5,720,504
Copper ore	1	3,838	296	59,069	233,625	2,105	----------
Lead ore	69	42,750	1,860	221,712	85,626	4,853,012	356,648
Lead-copper ore	1	27	1	444	1,875	11,086	----------
Zinc ore	12	182,665	2,654	147,460	63,239	3,494,175	36,654,470
Zinc-lead ore [1]	68	526,201	32,048	1,286,137	3,597,517	34,729,813	52,674,378
Total	151	755,481	36,859	1,714,822	3,981,882	43,090,191	89,685,496
Total lode mines [2]	255	1,262,355	89,475	2,892,085	4,806,000	53,706,000	95,406,000
Placers	27	----------	13,143	2,801	----------	----------	----------
Total: 1949	282	1,262,355	102,618	2,894,886	4,806,000	53,706,000	95,406,000
1948	294	1,438,119	154,802	3,011,011	4,596,000	50,286,000	90,328,000

[1] Includes zinc-lead-copper ore, for which the Bureau of Mines is not at liberty to publish separate figures.
[2] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

[1] King, William H., and Allsman, Paul T., Reconnaissance of Metal Mining in the San Juan Region, Ouray, San Juan, and San Miguel Counties, Colo.: Bureau of Mines Inf. Cir. 7554, 1950, 109 pp.

METALLURGIC INDUSTRY

The Golden Cycle mill at Colorado Springs, built in 1905–06 and the largest gold-ore-treatment mill in Colorado for more than 25 years, closed February 20, 1949, and was later dismantled. The mill has treated the entire output of ore from the Cripple Creek district and a substantial tonnage from other districts for many years. During 1949 the Golden Cycle Corp. began constructing a new 1,000-ton custom mill at Cripple Creek, to be called the Carlton mill, to replace the Golden Cycle mill as a market for Cripple Creek ore. The treatment method will retain the fundamental (roasting and cyanidation) processes formerly used in the Golden Cycle mill. The main changes will be that all the ore received, instead of only the lower grade, will be concentrated by flotation, and only concentrate will be roasted; the calcines discharged from the roasters will go direct to cyanidation instead of first being passed over blankets to recover free gold for amalgamation; and the new carbon-cyanide process will be used to recover gold from the flotation tailings, all of which will continue to be given a cyanide treatment.

Most of the ores from districts other than Cripple Creek were treated by selective flotation mills, some of which used gold jigs in the ball mill-classifier circuit. Thirty-six Colorado mills, with capacities ranging from 25 to 1,500 tons and averaging about 210 tons, were operated all or part of the year.

The Arkansas Valley smelter at Leadville purchases most of the State siliceous gold-silver and lead concentrates and silver, lead-copper, and lead ores shipped to smelters. Copper concentrates are shipped to the Garfield, Utah, and El Paso, Tex., smelters. Custom mills and smelters in the Salt Lake Valley, Utah, are important as a market for Colorado zinc-lead ores and concentrates. Zinc concentrates are shipped to Amarillo and Dumas, Tex.; Depue, Ill.; Palmerton, Pa.; and Anaconda and Great Falls, Mont.

Mine production of metals in Colorado in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore and concentrates amalgamated	23,310	10,265			
Sands and slimes cyanided	9,898	2,007			
Concentrates smelted	51,332	2,603,913	4,420,309	51,472,588	95,359,810
Ore smelted	4,935	275,900	385,691	2,233,412	46,190
Placer	13,143	2,801			
Total: 1949	102,618	2,894,886	4,806,000	53,706,000	95,406,000
1948	154,802	3,011,011	4,596,000	50,286,000	90,328,000

Tables on the following three pages show details of Colorado ores milled and smelted in 1949.

Mine production of metals from Colorado ore milled in 1949, in terms of recoverable metals

	Ore treated (short tons)	Recoverable in bullion		Concentrates smelted and recoverable metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Boulder	15,335	250	853	486	290	58,338	16,000	208,753	----------
Chaffee	579	12	8	71	20	533	----------	34,909	24,000
Clear Creek	22,905	1,113	397	2,950	1,909	81,845	32,976	1,462,743	832,000
Custer	707	4	23	161	7	1,629	----------	64,585	68,000
Dolores	19,958	15	4	5,036	54	75,894	63,332	2,488,779	2,708,000
Eagle	171,099	--------	--------	42,497	330	120,173	45,287	3,167,746	34,900,000
Gilpin	1,260	28	7	62	68	491	----------	12,157	----------
Gunnison	15,529	--------	--------	5,088	60	56,738	34,000	2,496,644	3,008,000
Hinsdale	241	--------	--------	69	12	2,099	6,560	49,199	29,910
Lake	128,125	4,890	2,368	27,847	8,407	187,048	221,934	9,526,144	12,910,000
La Plata	1	7	1	--------	--------	----------	----------	----------	----------
Mineral	37,944	--------	--------	3,856	770	255,007	74,000	2,310,984	1,342,000
Ouray	47,817	43	10	5,352	2,454	166,117	345,922	2,849,344	2,748,000
Park	2,250	516	85	699	955	7,659	4,813	62,334	506,000
Pitkin	6,194	--------	--------	315	--------	32,550	----------	163,148	98,000
Rio Grande	2,750	--------	--------	55	82	201	4,000	----------	----------
Saguache	4,717	36	289	1,641	60	21,195	41,587	611,734	738,000
San Juan	243,965	--------	--------	11,025	11,216	579,295	598,874	6,889,513	3,151,900
San Miguel	370,829	13,013	6,489	31,339	22,702	648,707	2,798,948	10,816,810	12,008,000
Summit	123,404	294	164	40,464	1,936	308,394	132,076	8,257,062	20,288,000
Teller	23,042	12,987	1,574	--------	--------	----------	----------	----------	----------
Total: 1949	1,238,651	33,208	12,272	179,013	51,332	2,603,913	4,420,309	51,472,588	95,359,810
1948	1,416,321	74,752	15,463	168,025	62,492	2,534,908	4,137,078	47,721,254	89,969,765
BY CLASSES OF ORE TREATED									
Dry gold	214,496	21,981	6,506	13,283	15,383	163,306	208,060	4,614,164	3,368,962
Dry gold-silver	224,183	93	787	5,111	10,424	535,308	402,282	3,199,516	850,819
Dry silver	61,733	--------	--------	4,502	951	360,041	80,494	2,601,405	1,500,633
Lead	29,563	--------	--------	3,658	1,170	118,404	72,564	2,881,689	356,648
Zinc	182,665	804	209	45,097	1,850	147,251	63,239	3,494,175	36,654,470
Zinc-lead	360,130	5,057	2,799	89,422	13,788	863,778	1,031,110	28,651,957	43,972,754
Zinc-lead-copper	165,881	5,273	1,971	17,940	7,766	415,825	2,562,560	6,029,682	8,655,524
Total 1949	1,238,651	33,208	12,272	179,013	51,332	2,603,913	4,420,309	51,472,588	95,359,810
BY CLASSES OF CONCENTRATES SMELTED									
Dry gold				118	331	2,943	270	5,560	----------
Copper				4,633	5,367	131,726	2,218,686	170,546	----------
Lead				49,499	31,314	1,695,210	1,009,723	44,270,437	123,176
Lead-copper				5,560	6,391	510,702	518,496	4,430,491	----------
Dry iron [1]				11,164	3,671	41,764	6,351	689,133	471
Total to copper and lead plants				70,974	47,074	2,382,345	3,753,526	49,566,167	123,647
Zinc concentrates to zinc plants				108,039	4,258	221,568	666,783	1,906,421	95,236,163
Total 1949				179,013	51,332	2,603,913	4,420,309	51,472,588	95,359,810

[1] From zinc-lead, lead, silver, and gold-silver ores.

REVIEW BY COUNTIES AND DISTRICTS

ADAMS COUNTY

Kerkling & Slensker recovered gold and silver as byproducts at the Brannan Sand & Gravel Co. washing plants Nos. 8 and 10 and the Superior Sand & Gravel Co. pit, all on gravel bars of Clear Creek

Gross metal content of concentrates produced from ores mined in Colorado in 1949, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	118	331	2,943	992	5,863	
Copper	4,633	5,367	131,726	2,288,137	310,330	130,000
Lead	49,499	31,314	1,695,210	1,281,820	46,124,908	4,734,845
Lead-copper	5,560	6,391	510,702	659,465	4,614,462	676,449
Dry iron [1]	11,164	3,671	41,764	7,975	718,353	319,989
Total to copper and lead plants	70,974	47,074	2,382,345	4,238,389	51,773,916	5,861,283
Zinc concentrates to zinc plants	108,039	5,813	300,328	797,339	2,833,458	105,587,970
Total: 1949	179,013	52,887	2,682,673	5,035,728	54,607,374	111,449,253
1948	168,025	64,429	2,607,357	4,693,582	50,717,313	106,240,964

[1] From zinc-lead, lead, silver, and gold-silver ores.

Gross metal content of Colorado crude ore shipped to smelters in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold ore	861	2,115	7,410	11,014	22,613	110
Dry gold-silver ore	816	1,510	18,738	356	20,445	
Dry silver ore	4,786	159	85,191	158,349	171,114	116
Copper ore	3,838	296	59,069	240,851	3,508	
Lead ore	13,186	690	103,298	19,763	2,055,174	49,296
Lead-copper ore	27	1	444	2,337	11,601	
Total to copper and lead plants	23,514	4,771	274,150	432,670	2,284,455	49,522
Zinc-lead ore to zinc plants	190	164	1,764	4,526	49,007	63,675
Total: 1949	23,704	4,935	275,914	437,196	2,333,462	113,197
1948	21,798	4,311	457,828	514,301	2,685,998	540,149

northwest of Denver. Experimental work on gold recovery at another plant yielded some gold.

BOULDER COUNTY

Central (Jamestown) District.—Gold ore was shipped from the John Jay-Last Chance group in 1949. The Ozark-Mahoning Co. and the General Chemical Co. shipped lead-silver-gold-copper concentrate recovered as a byproduct in the beneficiation of fluorspar.

Gold Hill District.—The Cash mine, operated steadily by Henna Mines., Inc., produced 895 tons of ore yielding 1,600 ounces of gold, 19,421 ounces of silver, and 19,205 pounds of lead, with a total gross value of $68,449 and a net return to the mine of $52,697. A little ore was shipped from the Parker No. 2 and Twin Shaft claims. Placer gold was recovered from a clean-up of launders at a gravel-washing plant on the George Sawhill ranch.

Grand Island District.—The Caribou mine operated 12 months and the mill 7 months in 1949. This mine was the largest Boulder County producer of silver during the year; it is opened by a 3,600-foot adit and

Mine production of metals from Colorado crude ore shipped to smelters in 1949, in terms of recoverable metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Boulder	896	1,626	19,052		31,247	
Chaffee	265	55	3,029		61,091	
Clear Creek	106	46	4,046	1,024	29,257	
Custer	504	8	14,409		39,415	
Dolores	492	10	4,134	2,668	287,221	
Eagle	6,572	436	96,416	358,713	32,254	
Fremont	37	20	31			
Gilpin	14	7	103		5,843	
Gunnison	273	4	3,409		89,356	
Hinsdale	124	11	1,240	1,440	48,801	90
Lake	10,816	1,171	32,691	8,066	633,856	
La Plata	37	210	2,285			
Mineral	318	9	8,860		13,016	
Montezuma	8	16	73			
Ouray	473	327	40,540	78	192,656	
Park	780	37	5,516	1,187	175,666	
Pitkin	3		142		852	
Saguache	50	2	486	413	26,266	
San Juan	403	333	4,773	9,126	136,487	46,100
San Miguel	51	67	448	1,052	11,190	
Summit	1,307	67	32,802	1,924	418,938	
Teller	175	473	1,415			
Total: 1949	23,704	4,935	275,900	385,691	2,233,412	46,190
1948	21,798	4,311	457,828	458,922	2,564,746	358,235
BY CLASSES OF ORE						
Dry gold ore	861	2,115	7,410	8,177	18,651	
Dry gold-silver ore	816	1,510	18,738	2	18,073	
Dry silver ore	4,786	159	85,177	125,103	164,000	90
Copper ore	3,838	296	59,069	233,625	2,105	
Lead ore	13,186	690	103,298	13,062	1,971,323	
Lead-copper ore	27	1	444	1,875	11,086	
Total to copper and lead plants	23,514	4,771	274,136	381,844	2,185,238	90
Zinc-lead ore to zinc plants	190	164	1,764	3,847	48,174	46,100
Total 1949	23,704	4,935	275,900	385,691	2,233,412	46,190

a 540-foot shaft. Development in 1949 totaled 1,319 feet of drifts and 2,931 feet of diamond drilling.

Sugar Loaf District.—Producers in this district were the Franklin, Livingston, Cutout, and Nancy mines and a prospect.

CHAFFEE COUNTY

Chalk Creek District.—A test run of 370 tons of ore from the Mary Murphy dump was made by S. E. and W. E. Burleson in a jig mill installed on the property. The Stonewall mine shipped 231 tons of ore and the Ester No. 1 mine 8 tons.

Granite District.—A 2-ton lot of gold ore was shipped from the Hygra group in 1949. Some gold was produced at the Gold Basin (Good Hope) and Lost Canyon placers.

Monarch District.—The Garfield mine was operated from January to May 4 and from November 12 through December by S. E. and W. E. Burleson. The operators did 900 feet of drifting, crosscutting, and raising and shipped 100 tons of ore containing 49 ounces of gold, 353 ounces of silver, 34,660 pounds of lead, and 4,400 pounds of zinc.

From the New York mine, Earl Waite and A. W. Emerson shipped 42 tons of ore containing 1 ounce of gold, 2,177 ounces of silver, 566 pounds of copper, 3,961 pounds of lead, and 13,550 pounds of zinc. Other producers were the Lilly dump and the C. Ray Miller & Son Mining Co. property.

CLEAR CREEK COUNTY

Alice District.—In 1949 Lombard Mines, Inc., operated the Lombard mine and 100-ton flotation mill from January to June 14, when operations were interrupted by a bad surface cave. The mill product was gold-silver-lead-copper concentrate.

Argentine District.—The Grizzly Gulch mine, a substantial producer in 1948, was in production from January to June 1949. Operations the rest of the year were confined to development work. A little ore was shipped from a prospect.

Cascade District.—The Tyone Mining Co. drove 257 feet of crosscut in the Tyone mine and shipped some ore.

Empire District.—The P. M. Lessors worked the Gold Fissure group 90 days in 1949, producing silver-copper-lead ore. A truckload of ore was shipped from the Bonus mine.

Griffith District.—At the Terrible-Dunderberg group Gold Mines Consolidated, Inc., continued to mine ore until October 23 and worked on exploration the rest of 1949. The ore was milled in the Silver Spruce mill at Idaho Springs. The mill heads totaled 5,825 tons with an average assay at the mill of 0.03 ounce of gold and 7.27 ounces of silver a ton, 5.63 percent lead, and 7.01 percent zinc. The mill recovered 1,257 tons of bulk concentrate containing 0.16 ounce of gold and 24.40 ounces of silver a ton, 27.44 percent lead, and 27.07 percent zinc, with a gross value of $125,948; the net value after deducting transportation, treatment, and other charges, was $90,090. Most of the concentrate was sold to a custom selective-flotation mill at Leadville. The Smuggler group and Silver Leaf mill were operated intermittently by the Smuggler Mine (C. O. Parker, agent) and the Mile High Mining Co. Small lots of ore were shipped from the Collins and Stevens properties.

Idaho Springs District.—The principal producers in the Idaho Springs district in 1949 were the Franklin Mining Co. (Franklin mine), producing lead-gold-silver-zinc ore, and the Dixie mine of LeRoy Giles & Co., producing gold ore. The Franklin ore was treated in custom mills at Leadville and Idaho Springs, and the Dixie ore went to the company mill near Idaho Springs. Arthur Portenier operated the Ruth mill several months, treating ore from the Diamond Joe, Crazy Girl (Trail district), and Kitty Clyde mines. The Clear Creek-Gilpin and Black Eagle mills treated some custom ore. Other producing mines included the Brighton, Consolidated Park, Valentine, and Williams dump.

Montana District.—The Nabob Development Co. sank 50 feet of shaft and drove 250 feet of drifts on the Nabob property in 1949 and shipped 648 tons of ore containing 63 ounces of gold, 22,318 ounces of silver, 6,639 pounds of copper, and 84,376 pounds of lead. Bellevue Mines, Inc., drove 150 feet of raise, 55 feet of drifts, and 455 feet of tunnel in the Bellevue mine and shipped lead-silver-gold ore. Some ore was cleaned up and shipped from the Joe Reynolds property.

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1949, by countie

County and district	Mines producing		Ores sold or treated (short tons)	Gold [1] (fine ounces)
	Lode	Placer		
Adams County		4		775
Boulder County:				
Central (Jamestown)	3		53	285
Gold Hill	3	1	895	1,635
Grand Island	1		15,003	156
Sugar Loaf	5		280	119
Chaffee County:				
Chalk Creek	3		609	34
Granite	1	2	2	17
Monarch	4		233	52
Clear Creek County:				
Alice and Empire	3		3,060	394
Argentine and Griffith	6		9,714	255
Cascade	1		24	11
Idaho Springs	15	2	8,126	2,311
Montana	3		1,014	28
Trail Creek or Freeland (Lamartine)	5		1,073	72
Custer County: Hardscrabble	4		1,211	19
Dolores County: Pioneer	6		20,450	79
Eagle County:				
Holy Cross	1		8	7
Red Cliff	3		177,663	759
Fremont County	1		37	20
Gilpin County:				
Southern	8	3	974	67
Northern	1	3	300	68
Gunnison County:				
Elk Mountain	2		855	5
Gold Brick	1		5	1
Tin Cup	1		266	3
Tomichi	1		14,676	85
Hinsdale County:				
Galena	8		324	20
Lake	4		41	3
Jefferson County		3		62
Lake County: California (Leadville) [2]	25	1	138,941	17,996
La Plata County: California	5		38	217
Mineral County: Creede	6		38,262	779
Montezuma County	1		8	16
Montrose County: San Miguel River		1		1

Ouray County:				
Red Mountain	11		3,539	81
Sneffels	4		41,336	2,671
Uncompahgre	4		3,365	72
Park County:				
Alma Placers-Fairplay		4		8,697
Buckskin	4		2,419	1,398
Consolidated Montgomery	1		156	3
Mosquito	2		455	107
Pitkin County: Roaring Fork	3		6,197	
Rio Grande County: Summitville and Decatur	1		2,750	82
Saguache County:				
Cochetopa	1		6	
Kerber Creek	10		4,761	98
San Juan County:				
Animas	19		227,463	10,658
Eureka	12		16,905	891
San Miguel County:				
Iron Springs	1		23,530	565
Upper San Miguel [3]	6	2	347,350	35,224
Summit County:				
Breckenridge	8	1	3,798	149
Green Mountain	1		354	11
Montezuma	15		4,690	31
Ten Mile	8		115,869	2,129
Teller County: Cripple Creek	13		23,217	13,460
Total Colorado	255	27	1,262,355	102,618

[1] Bureau of Mines not at liberty to show separate figures for placer production by districts in 1949.
[2] Includes placer gold and silver from Box Creek district and small quantity of silver and lead from Sugar Loaf dis
[3] Includes 7 ounces of placer gold, 2 ounces of placer silver, and 10 ounces of lode silver from Lower San Miguel dist

45,075	12,000	385,000	398,000	156,176
144,037	316,000	2,128,000	2,106,000	883,466
17,555	18,000	529,000	244,000	135,792
1,569	------------	------------	------------	305,815
10,109	1,000	167,000	365,000	129,922
1,244	------------	52,000	------------	9,447
1,907	5,000	19,000	141,000	26,942
32,692	------------	164,000	98,000	67,652
201	4,000	------------	------------	3,840
21	------------	------------	2,000	267
21,949	42,000	638,000	736,000	223,637
539,402	511,000	5,870,000	2,058,000	2,144,535
44,666	97,000	1,156,000	1,140,000	414,727
76,136	44,000	259,000	------------	138,272
579,510	2,756,000	10,569,000	12,008,000	5,459,152
9,718	6,000	616,000	724,000	202,296
18,082	------------	21,000	26,000	23,292
59,274	9,000	697,000	106,000	179,774
254,294	119,000	7,342,000	19,432,000	3,897,711
2,989	------------	------------	------------	473,805
2,894,886	4,806,000	53,706,000	95,406,000	27,474,322

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s and districts, in terms of recoverable metals

Silver[1] (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Tota value
116	----------	----------	----------	$27,230
5,500	13,000	142,000	----------	39,950
19,423	----------	18,000	----------	77,648
53,188	3,000	80,000	----------	66,829
134	----------	----------	----------	4,286
672	----------	43,000	24,000	11,568
3	----------	----------	----------	598
2,897	----------	53,000	----------	12,816
675	3,000	21,000	----------	18,310
43,402	10,000	905,000	620,000	270,046
107	----------	5,000	----------	1,272
24,961	16,000	415,000	211,000	198,362
14,985	3,000	52,000	----------	23,349
2,159	2,000	94,000	1,000	19,844
16,061	----------	104,000	68,000	40,065
80,032	66,000	2,776,000	2,708,000	862,600
9	----------	----------	----------	253
216,580	404,000	3,200,000	34,900,000	5,135,369
31	----------	----------	----------	728
576	----------	18,000	----------	5,710
34	----------	----------	----------	2,411
1,747	2,000	56,000	96,000	22,902
33	----------	----------	----------	65
3,371	----------	89,000	----------	17,218
54,996	32,000	2,441,000	2,912,000	804,769
2,794	8,000	90,000	27,000	22,373
545	----------	8,000	3,000	2,234
9	----------	----------	----------	1,128
223,190	230,000	10,160,000	12,910,000	4,083,288
2,286	----------	----------	----------	9,664
263,867	74,000	2,324,000	1,342,000	814,256
73	----------	----------	----------	626
----------	----------	----------	----------	35

Trail Creek District.—The Victoria Mining Co. shipped about 900 tons of ore from the Victor Lode group in 1949. About 100 tons of ore were shipped from the Ben Harrison dump and smaller quantities from the Gum Tree, Freeland-Toledo, and New Era mines.

CUSTER COUNTY

Hardscrabble District.—The producing mines in this district were the Defender and Lady Franklin, operated from January through May; the Passiflora, worked 60 days; the Thames River, active during January and February; and the Wild Girl, worked a few days.

DOLORES COUNTY

Pioneer (Rico) District.—The Rico Argentine Mining Co., one of the major producers of zinc, lead, and silver in Colorado from 1939 through 1948, suspended mining operations at its group of mines in May 1949 because of the declining metal prices. Development work was continued, the mill was completely remodeled, and a substantial tonnage of old tailings was remilled. Development included 4,073 feet of drifts, 726 feet of raises, 8 feet of winze, and 6,388 feet of diamond drilling. Ore from the Forest mine, Sambo property, South Park mine, and Wellington group was shipped to custom plants outside the county. Some gold and silver were recovered by hand methods from the St. Louis property.

EAGLE COUNTY

Holy Cross District.—Two truckloads of gold ore were shipped from the Glengary group in 1949.

Red Cliff (Battle Mountain) District.—The output of zinc from this district in 1949 again exceeded by a large margin that of any other Colorado district or county. Large-scale development and mining of the Battle Mountain deposits since 1915 have put the Red Cliff district in second place among Colorado districts in total recorded output of zinc and in first place in total copper production; the district is also among the State's leading silver producers. From 1941 to 1949 the output was mostly zinc ore; during the period 1932–40 a large quantity of iron-copper-silver ore was produced. The Eagle mine and 600-ton underground flotation mill of the New Jersey Zinc Co., Empire Zinc Division, operated continuously in 1949. The mine is developed through a tunnel, a vertical shaft (used to hoist and lower men and supplies), and a series of inclines. It is completely mechanized. Electric battery motors are used for underground haulage. The Tip Top and Gold Park mines produced a small quantity of direct-smelting ore.

EL PASO COUNTY

The Golden Cycle mill of the Golden Cycle Corp. at Colorado Springs operated in 1949 until February 20 on company and custom gold and gold-silver ores. Receipts comprised 23,042 tons of mine and dump ores from the Cripple Creek district and 311 tons from Boulder County. The mill was cleaned up and dismantled during the year.

FREMONT COUNTY

Two lots of gold ore were shipped from Canon City by the Gold Queen Mining Co. in 1949.

GARFIELD COUNTY

A sample lot (less than 1 ton) of ore was shipped from Carbondale in 1949.

GILPIN COUNTY

Southern (Blackhawk, Central City, Nevadaville, Russell Gulch) Districts.—Small lots of lead ore were trucked to the Leadville smelter from the Arris, Boodle, Druid, Dumas-Kinney, Independence, and Washington Day properties. Ore from surface diggings on "The Patch" property was treated in the mill built in 1948 by Chain O'Mines Operators, Inc., and operated by the Illini Corp. a short period in December 1949. Some ore was shipped from the Quartz hill property, and placer gold was recovered by hand methods on North Clear Creek.

Northern Districts.—The Gold Chief Mines, Inc., operated the We Got Em mine and 50-ton concentration mill from September 1 to November 15. The mill products were table concentrate and free gold caught on tables and mats. A dragline and nonfloating washing plant were operated on the Fools Luck placer from June to August.

GUNNISON COUNTY

Elk Mountain District.—The Park City Consolidated Mines Co. took over the Keystone property in June 1949. The company drove about 700 feet of development drifts, which yielded 850 tons of zinc-lead-silver ore, shipped to a custom mill at Leadville for treatment. The property was closed December 10 because of snow. A small lot of lead ore was shipped from the Louise claim.

Gold Brick District.—Bert Tucker shipped 5 tons of gold-silver-lead ore from Ohio City in 1949.

Taylor Park (Tin Cup) District.—John Lambertson worked the Star mine in 1949 and shipped 266 tons of ore containing 92,815 pounds of lead, 3,371 ounces of silver, 3 ounces of gold, and 129 pounds of copper.

Tomichi District.—The Akron-Erie mine and 100-ton flotation mill of the Callahan Zinc-Lead Co., Inc., at White Pine operated throughout 1949. Ore treated totaled 14,676 tons, from which were recovered 1,746 tons of lead-silver concentrate averaging 0.018 ounce of gold and 25.55 ounces of silver to the ton, 63.4 percent lead, 12.8 percent zinc, and 0.50 percent copper; and 3,181 tons of zinc concentrate averaging 0.011 ounce of gold and 5.01 ounces of silver to the ton, 52.0 percent zinc, 8.2 percent lead, and 0.34 percent copper. Mine development during the year totaled 1,667 feet of drifts, 329 feet of crosscut, 623 feet of raises, and 1,090 feet of diamond drilling.

HINSDALE COUNTY

Galena District.—Shipments of ore in 1949 comprised 152 tons from the Yellow Medicine mine, 102 tons from the California, 48 tons from the Capital City, and 22 tons from other mines and dumps.

Lake District.—Small tonnages of ore were shipped from the Black Crook-Ilma-Hiwassee, W. C. Garlock, and Cora-Sulphuret mines and the Lake City smelter dump.

JEFFERSON COUNTY

The gold output from Jefferson County in 1949 was recovered as a byproduct from gravel-washing plants.

LAKE COUNTY

Box Creek District.—The General Gold Corp. operated its Mount Elbert placers throughout the 1949 season, which lasted from April 1 to October 31. Equipment used included two dragline dredges and a bulldozer.

California (Leadville) District.—The output of silver, copper, lead, and zinc in the Leadville district in 1949 was larger than in 1948 despite some curtailments in development and mining operations caused by the drop in base-metal prices. Gold production, however, decreased.

The Resurrection Mining Co. operated its group of mines continuously and was again the principal producer of all five metals. The mine is opened by a 1,323-foot vertical shaft, six levels, and a 4-mile tunnel (old Yak) which intersects the shaft. Development work proceeded at the usual rate. The mill operated largely on company ore but also treated custom ore from Chaffee, Clear Creek, Custer, Lake, Park, Saguache, and Summit Counties.

The American Smelting & Refining Co. operated its 400-ton Leadville milling unit on a 6-day work week throughout 1949. The bulk of the ore treated came from the company Victory mine group at Kokomo, Summit County. The company Ibex-Garbut-Cora-Sunday group at Leadville was under development, with some production, throughout the year. The mill also treated custom ore from mines in Clear Creek, Gunnison, Hinsdale, Lake, Mineral, Ouray, Park, Rio Grande, Saguache, and Summit Counties.

The Fortune and New Monarch mines, operated by lessees, were consistent shippers to custom plants. Work at the New Monarch included considerable development on the Silent Friend vein on the 6th level of the Monarch shaft. Other shippers included the American smelter dump, A. Y. & Minnie, Ben Franklin mine, Chautauqua, Dolly B, Fanny Rawlings, Helen, Little Ellen, Moyer Placer, Rock & Dome, St. Louis, and Thomas Starr Placer. The Cloud City and Valentine mills treated some dump ore. The John Hamm Mining & Milling (Ltd.) mill was dismantled.

The Arkansas Valley smelter of the American Smelting & Refining Co. operated continuously. The smelter treats lead, lead-copper-gold-silver, and gold and silver ores and concentrates purchased from operators in nearly all the active mining districts of Colorado and concentrates, residues from zinc smelters, and other material from outside the State. Receipts in 1949 totaled 103,386 tons (97,150 tons in 1948).

In November the Bureau of Mines reactivated the Leadville drainage tunnel project, on which work began in 1943 and was discontinued September 1, 1945. The appropriation for the United States Department of the Interior for the fiscal year 1950 includes $250,000 cash and $250,000 contract authority for the project. The tunnel is designed to drain the mines in the Carbonate Hill, Evans Gulch, and Fryer Hill areas and part of the Downtown area; its contemplated length, including laterals, is 17,000 feet, of which 6,600 feet have already been

driven. The portal elevation is 9,957 feet. Test core drilling ahead of tunneling was being done by the Bureau staff in December 1949. Data on examination, mapping, and sampling in the district were published.[2]

Sugar Loaf District.—A sample of material from the Dinero dump was run in the Cloud City mill at Leadville and yielded 1 ton of silver-lead concentrate.

LA PLATA COUNTY

California (La Plata, Hesperus) District.—The Bessie G., Golden Rose, and Neglected mines shipped small tonnages of gold ore to smelters in 1949. Some silver ore was shipped from the Muldoon and Sarah G. properties.

MINERAL COUNTY

Creede District.—The Emperius Mining Co. operated its group of mines at Creede continuously in 1949. The group includes the Amethyst, Commodore, New York-Volunteer-Del Monte-Aspen, and Equinox properties. The output of lead and zinc was much larger than in 1948, and the group continued to be one of the leading producers of silver in the State. Improvements were made in the mill that increased its efficiency for selective flotation, and both lead-silver and zinc concentrate were produced. Some of the high-grade ore was shipped direct to the Leadville smelter. The Ridge (Mexico Mining Co.) mine, worked by lessees from January to November, shipped several cars of lead-zinc ore.

MONTEZUMA COUNTY

About a truckload of gold ore was shipped by the Wm. R. Westfall lease in the vicinity of the Red Arrow mine.

MONTROSE COUNTY

A little placer gold was recovered on San Miguel River.

OURAY COUNTY[3]

Red Mountain District.—The American Zinc, Lead & Smelting Co. operated the Mountain King group and the Kaemmerling property 8 months. The Lost Day mine was operated by the Morningside Development Co. nearly 8 months; output was 430 tons of ore containing 39,872 ounces of silver, 187,437 pounds of lead, and 11 ounces of gold. The company also shipped 30 tons of ore of a similar type from the Stanley Kremlin-J. I. C. group. Lessees operated the Ida L (Larson) mine intermittently. Other small producers included the Greyhound, Highland Lassie, and several prospects. The Idarado mill treated ore from claims in San Miguel County.

Sneffels District.—The Camp Bird mine, leading producer of all five metals in Ouray County, was operated by King Lease, Inc. During the year the company replaced 5,000 feet of 30-pound rail with 65-pound rail on the main haulage level and did 572 feet of raising, 761 feet of drifting, 335 feet of crosscutting, and 2,049 feet of diamond

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[2] Ebbley, Norman E., Jr., and Schumacher, John I., Examination, Mapping, and Sampling of Mine Shafts and Underground Workings, Leadville, Lake County, Colo.: Bureau of Mines Rept. of Investigations 4518, 1949, 115 pp.

[3] Hazen, Scott W., Jr., Lead-Zinc-Silver in the Poughkeepsie District and part of the Upper Uncompahgre and Mineral Point Districts, Ouray and San Juan Counties, Colo.: Bureau of Mines Rept. of Investigations 4508, 1949, 110 pp.

drilling. The mine has more than 7 miles of underground workings. The combined lead and zinc concentrates made from 38,755 tons of ore treated in the company 125-ton flotation mill contained 2,083 ounces of gold, 137,397 ounces of silver, 364,247 pounds of copper, 2,127,659 pounds of lead, and 2,209,336 pounds of zinc. Lessees on a dump of the Camp Bird property shipped considerable ore. The Atlas, Jack Pot, and Minnie B mines produced some ore.

Uncompahgre District.—The American Zinc, Lead & Smelting Co. 300-ton custom mill at Ouray treated ore from about 38 mines in Ouray and San Juan Counties. The producing company mine in the Uncompahgre district was the Bachelor, operated from January through May. The Mickey Breen (Monarch) mine of Southwest Metals, Inc., was a good producer of lead-zinc-silver ore. Some ore was shipped from the Highland Chief mine, and a little gold was recovered by hand methods at the Wanakah millsite.

PARK COUNTY

Alma Placers-Fairplay District.—In 1949 the South Platte Dredging Co. operated its electrically powered bucket-line dredge (108 12-cubic-foot buckets) on South Platte River from March 22 through December; gravel washed totaled about 3,400,000 cubic yards, and output of gold was larger than in 1948. Small-scale placer miners produced some gold.

Buckskin District.—The Buckskin Joe Mines, Ltd., continued to operate the Phillips group and did exploratory development work. The ore produced was shipped to the Resurrection mill at Leadville. The American Flag, Criterion, and Sweet Home mines shipped some ore.

Consolidated Montgomery District.—W. E. Van Cooten shipped 156 tons of lead-silver ore in 1949.

Mosquito District.—The Orphan Boy mine shipped 454 tons of zinc-lead-gold-silver ore to custom plants at Leadville. A little gold ore was shipped from the Dauser mine. Development work was continued at the London Butte property.

PITKIN COUNTY

Roaring Fork (Aspen) District.—The Midnight Mining Co. operated its Midnight mine throughout 1949. The ore produced resulted from a program of prospecting in the near vicinity of the worked-out stopes of the main ore body. The mill feed totaled 6,194 tons, which yielded 194 tons of lead concentrate averaging 157.58 ounces of silver a ton and 42.19 percent lead; and 121 tons of zinc concentrate averaging 46.43 percent zinc and 25.26 ounces of silver a ton. Two small lots of ore and clean-up material containing lead and silver were shipped from other properties. The Aspen Mining Co. carried on exploratory drilling and crosscutting in the Smuggler-Durant group. The Bureau of Mines did exploratory drilling near Aspen during January and February.

RIO GRANDE COUNTY

Summitville District.—Jones & Nylene operated the Summitville mine 4 months in 1949. The ore produced was concentrated in the mill on the property. Mine development during the period included 280 feet of drifts.

SAGUACHE COUNTY

Cochetopa District.—The Cochetopa Mining Co., Inc., drove 56 feet of drifts on the Alaska Yukon Bell group and shipped 6 tons of zinc-lead-silver-copper ore containing arsenic.

Crystal Hill District.—The Crystal Hill Mining Co. built a mill at Center to be used for treating ore from the company Crystal Hill-Esperanza group of gold mines 18 miles west of Center, which are expected to operate in 1950.

Kerber Creek (Bonanza) District.—The largest producer in this district was the Antoro mine, operated continuously by S. E. and W. E. Burleson; ore shipped totaled 4,012 tons averaging 0.022 ounce of gold and 6.26 ounces of silver per ton, 1.03 percent copper, 8.24 percent lead, and 11.01 percent zinc. Other producing mines were the Blue Moon, Bonanza, Cocomongo, Brighton, Cora, Jupiter, Helen Mae, Liberty, Little Jenny, Herman W. Baca, and Rawley.

SAN JUAN COUNTY

Animas District.—The Shenandoah-Dives Mining Co., a large, steady producer since 1928, operated continuously its Shenandoah-Dives consolidated group of claims and the leased Silver Lake group. The two groups were operated as a unit. Mine development and exploration in 1949 included 3,248 feet of drifts, 158 feet of crosscuts, 642 feet of raises, and 1,673 feet of diamond drilling. The mine is connected with the company 700-ton mill by an aerial tram nearly 2 miles long. Company ore milled in 1949 totaled 186,072 tons and custom ore 15,259 tons. The yield of concentrates from the 201,331 tons of ore treated was 4,382 tons of flotation lead concentrate, 1,763 tons of flotation zinc concentrate, and 771 tons of iron-gold-silver-lead table concentrate containing in aggregate 9,093 ounces of gold, 459,719 ounces of silver, 510,301 pounds of copper, 4,470,457 pounds of lead, and 2,620,624 pounds of zinc.

Pride of the West, Inc., operated the Great Eastern mine 5 months and the Pride of the West-Green Mountain group 7 months, treating the ore in the company 100-ton flotation mill. The Osceola Mining & Milling Corp. operated the New Green Mountain (Osceola) and Lackawana mill from January to November. The Old Hundred-Gary Owen group was worked under lease by H. A. Reuther from January to April and by the Old Hundred Mining Co., owner, the rest of the year; shipments—all to custom mills—totaled 4,010 tons of lead-zinc-silver ore. The Highland Mary mine and mill operated from May 1 through December. Ore milled totaled 10,184 tons. The Blackstone-Lark and Silver Ledge mines shipped ore to custom plants. Other shippers included the Ben Franklin, Independence group, Mighty Monarch, Little Fannie, May Day, Little Nation, and Silver Cloud mines and several dumps.

Eureka District.—In 1949 the Columbus (Foursome) group shipped to custom mills more than 8,000 tons of zinc-lead-silver ore and treated some ore in addition in a small stamp mill at the mine. The Lead Carbonate mine and 40-ton flotation mill operated from January through August. Lessees at the Lucky Jacks mine shipped 817 tons of ore. Other small shippers included the Burrows, Caledonian, Cashier, Gold King, Great Eastern-Sioux City, Queen Anne, Silver Crown, and Treasure Mountain (Scotia).

Ice Lake Basin District.—Lessees at the South Mineral group drove 50 feet of drifts, did timbering and repair work, and shipped some ore.

SAN MIGUEL COUNTY

Iron Springs District.—The Silver Bell group and 150-ton mill were operated throughout 1949 by the Silver Bell Mines Co. Development during the year totaled 1,203 feet of drifts and 400 feet of raises. The mill product was bulk gold-silver-lead-copper concentrate. A new washing-sorting plant was being built as the year ended.

Lower San Miguel District.—A 1-ton test lot of silver-lead ore was shipped from the Little Eva claim. A little placer gold was recovered on San Miguel River.

Upper San Miguel District.—The output of zinc in this district increased 72 percent, lead 39 percent, copper 11 percent, and silver 10 percent from 1948. Gold production decreased 8 percent but was still higher than that of any other district in the State.

The Smuggler Union-Montana group of Telluride Mines, Inc., was the largest Colorado producer of gold in 1949 and an important producer of silver, lead, and zinc. Development during the year, including that driven in the new mill-level tunnel, totaled 5,747 feet of drifts, 690 feet of raises, 3,234 feet of tunnel, and 200 feet of diamond drilling. The mill has a daily capacity of 550 tons. The circuit was changed from bulk flotation to selective flotation. The crushed ore is ground in a Marcy ball mill and discharged over two Denver jigs to remove a gold concentrate, which is amalgamated. The jig tailings go to a Dorr classifier. The classifier overflow goes first to lead-copper flotation and then to zinc flotation.

The Idarado Mining Co. Black Bear-Ajax group, one of the leading producers of the five metals in the State, operated continuously. The mine is opened by the 12,000-foot Treasury tunnel, with its portal in Ouray County. The 1,100-foot raise on the Black Bear vein from the tunnel level was completed, and development of the Ajax and Argentine vein systems was continued. An underground primary crushing plant, capable of handling 200 tons an hour, was installed and put in operation at the raise. The company 500-ton mill, also in Ouray County, operated at capacity.

There were small outputs from the Andrus (East Ridge) group, Florence Lease, Thomas Hudson property, Tomboy group, and Kellog group.

SUMMIT COUNTY

Breckenridge District.—The Wellington mine, operated by W. L. Davenport, shipped to custom plants at Leadville 2,766 tons of ore containing 92 ounces of gold, 9,168 ounces of silver, 8,871 pounds of copper, 567,597 pounds of lead, and 917,326 pounds of zinc. Other small producers included the Briar Rose, Fredonia, Jumbo, Lancaster, Minnie, Monte Cristo, and Panther No. 2 lode properties and B & B placer.

Green Mountain District.—Frances L. McDaniel worked the Big Four mine and shipped zinc-lead-silver ore.

Montezuma District.—The Florado Mining Co. Pinnicle mine and 100-ton flotation mill operated intermittently. The Chatauqua mine was a substantial producer of silver and lead; most of the ore mined

was treated in the Teller Basin mill. Other small producers included the Bullion, Chatauqua Extension, Erickson, Mohawk, Quail, Radical, Rose, Silver King, Silver Wing, Waterloo, and Wauneita.

Ten Mile (Kokomo, Robinson) District.—The Kokomo unit (Victory group) of the American Smelting & Refining Co. was the largest producer of lead and the second-largest producer of zinc in the State in 1949 and ranked fourth in silver production. The ore also carries gold and copper. The production rate throughout the year was about the same as in 1948. The ore was trucked to the company Leadville milling unit for treatment. The Colonel Sellers mine shipped more than 3,000 tons of zinc-lead-silver-gold ore. The Wilfley mine shipped about 1,600 tons of zinc ore. Smaller shippers included the Kimberly, Michigan-Snowbank-Porter J, Nettie B, Lascanette, and K. S. & R. properties.

TELLER COUNTY

Cripple Creek District.—Mines in the Cripple Creek district continued to ship ore to the Golden Cycle mill at Colorado Springs until February 20, 1949, when the mill was closed. The rest of the year all the district mines were idle except those that worked on development and two that shipped small tonnages of ore to the Leadville smelter. The Golden Cycle Corp. worked on building its Carlton mill on the highway between Cripple Creek and Victor. The new mill is designed to replace the Golden Cycle mill as a market for Cripple Creek ore. The district output in 1949 (including gold recovered in the cleanup of the Golden Cycle mill) was 13,460 ounces of gold and 2,989 ounces of silver compared with 53,569 and 5,139 ounces, respectively, in 1948. Mines shipping more than 100 tons of ore in 1949 were the Cresson, Vindicator-Portland (United Gold Mines), Ajax (Golden Cycle Corp.), Elkton (dump), Tenderfoot-Sangre de Cristo-Mollie Kathleen, and Free Coinage. Operations of the first three mines, which produced 88 percent of the district total output of ore in 1949, are described in detail in annual reports to stockholders. The following data are abstracted from the reports.

Cresson Consolidated Gold Mining & Milling Co.—Despite the short period the Cresson mine operated in 1949, net gain for the year was $14,679, of which $11,784 was refund and interest on Federal income taxes levied in former years. This compares with a net gain of $16,548 for the full year 1948, a decrease of only $1,869, a good showing considering the heavy standby costs, taxes, and other necessary expenses to pay and no income during the last 10 months of the year. The shutdown period has been profitably utilized to do needed maintenance work and to complete installation of the Nordberg hoist, which will handle Cresson operations to a total depth of 5,000 feet.

Production of Cresson Consolidated Gold Mining & Milling Co., 1903–49

Period	Dry short tons	Gross value [1]	Freight and treatment	Net value	Dividends
1903–48	3,333,928	$47,956,031	$15,917,183	$32,038,848	$13,564,673
1949:					
Company ore	1,546	33,747	10,531	23,216	
Lessee ore	8,119	160,214	51,611	[2] 108,603	
1903–49	3,343,593	48,149,992	15,979,325	32,170,667	[3] 13,564,673

[1] Settlement value.
[2] Lessees received $51,888 as their share.
[3] Represents 28.17 percent of gross value and 42.16 percent of net value.

United Gold Mines Co.—Net loss for 1949 was $15,246 against a net loss in 1948 of $7,127. Since we operated so few days in 1949, production was very small. Company development on the Portland mine was concentrated in driving the Vindicator lateral on the Carlton tunnel level through Portland No. 2 shaft, in conjunction with the Cresson-Rose Nicol lateral drive, a joint operation with the Cresson Consolidated Gold Mining & Milling Co. On May 1, 1949, all underground lateral work was stopped, at which date the Cresson-Rose Nicol lateral had been driven a total of 1,829 feet and was approximately 2,000 feet from its ultimate objective, the projected position of the Cresson shaft. The Vindicator lateral had been driven 1,683 feet, leaving about 1,300 feet remaining to be driven to cut the first objective, the Ready Money vein of the Vindicator-Golden Cycle system.

Production of properties of United Gold Mines Co. in 1949, and before and after organization of the company (May 15, 1902) to Dec. 31, 1949

Mine	Net tons	Gross value [1]	Company ore cash receipts	Royalties received	Lessees' receipts
1949:					
Vindicator:					
Company ore	5,653	$23,631	$6,155		
Lessee ore	1,082	15,359		$3,416	$6,308
Portland: Lessee ore	297	14,012		5,957	5,677
Rose Nicol: Lessee ore					
Miscellaneous	54	448		24	201
Total 1949	7,086	53,450	6,155	9,397	12,186
Ore mined before consolidation	26,310	456,806	(2)	(2)	(2)
Production under operation of United Gold Mines Co	3,173,796	28,434,454	(2)	(2)	(2)
Total to Dec. 31, 1949	3,200,106	28,891,260	(2)	(2)	(2)

[1] Settlement value.
[2] Figure not available.

Golden Cycle Corp.—All mines in the Cripple Creek district owned by the Golden Cycle Corp. and mines of other major producers were shut down the middle of February to await erection of the new mill, located between Cripple Creek and Victor. The railroad ceased operating February 20, and the Golden Cycle mill stopped accepting ore shortly thereafter, so there was no mill to economically treat Cripple Creek ore the remainder of the year. Estimated on progress to date, barring unforeseen contingencies, the Carlton mill should be ready to accept custom ore in January 1951. It will have a nominal maximum capacity of 1,000 tons per day, but should the district production increase the capacity can very easily be increased to 1,500 tons a day.

During the brief operating period in 1949 the Golden Cycle mill treated a total of 23,353 net tons of ore, with a total gross value of $423,175, and an average per ton value of $18.12.

The Ajax mine ceased mining operations the middle of February 1949. During this short period it shipped 3,665 net tons of ore, with a total gross value of $117,981, and an average per ton value of $32.19. Company production was 2,952 net tons, with a total gross value of $111,760, and an average per ton value of $37.86; the average per ton ore value was raised considerably by the fact that in February 2 cars averaging $545 and $275 per ton were shipped. The shut-down period has been utilized to place the surface plant and the shaft in good operating condition, and the mine is ready to resume operations when the new mill is completed. Future ore production possibilities are excellent. Other wholly owned Golden Cycle Cripple Creek mining properties, including the Anchoria Leland, Index, and Cameron, did not operate during 1949.

East of the Mississippi River Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By Samuel A. Gustavson

GENERAL SUMMARY

MINE production of gold, copper, lead, and zinc reported by mines in the States east of the Mississippi River decreased 21, 22, 9, and 12 percent, respectively, in 1949 from that in 1948. The output of silver increased less than 1 percent. Lower prices for the base metals and work stoppages in the steel- and zinc-smelting and fabricating industries were the chief reasons for these decreases. Production of one or more of these five metals was reported from 119 lode mines and 2 placers in 12 of the States in the region. During 1949 the Eagle-Picher Mining & Smelting Co. and the Calumet & Hecla Consolidated Copper Co. each opened zinc-lead mines in the Northern Illinois-Wisconsin district, but the Vinegar Hill Zinc Co. in Wisconsin ceased production. Otherwise there was little change among the major producers. Demand for the base metals fell early in the year. Prices began to drop in March, and lows for 1949 were reached in late May and in June.

Production of the five metals (recoverable) in the region was 1,967 fine ounces of gold, 101,612 fine ounces of silver, 32,955 short tons of copper, 9,755 tons of lead, and 156,298 tons of zinc, with a total value of $56,788,593. The region's output was only a minor share of the United States production of gold and silver, but represented about 2 percent of the lead, 4 percent of the copper, and 26 percent of the zinc.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein, except that of zinc in New Jersey, has been calculated at the prices in the following table. The value of the New Jersey output is the total value of the zinc recoverable as metal and oxide after freight, haulage, smelting, and manufacturing charges are added.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31 1947: $0.905; 1948–49: $0.9050505.

[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

For copper the opening quotation, Connecticut Valley, was 23.5 cents per pound (highest since 1918). The low for 1949, reached June 17, was 16.0 cents and the year-end quotation was 18.5 cents. For lead the opening quotation, New York, was 21.5 cents per pound (highest on record). The low for 1949, first reached May 26, was 12.0 cents, which also was the year-end quotation. For zinc the opening quotation, E. St. Louis, was 17.5 cents (highest since 1916). The low, reached June 15, was 9.0 cents, and the year-end quotation was 9.75 cents.

Annual figures for the 5 years ended with 1949 and data showing the production of gold, silver, copper, lead, and zinc by months in terms of recoverable metal are given in accompanying tables. The figures for tonnage of ore sold or treated before 1949 do not include magnetite ore containing pyrite and chalcopyrite, from which copper, gold, and silver were recovered as byproducts. Minerals Yearbook, 1947 (p. 1379), contains a historical table showing mine production of gold, silver, copper, lead, and zinc in States east of the Mississippi River by years for 1906–47. The 1947 volume also contains a table (p. 1380) showing production of gold, silver, copper, lead, and zinc by months for 1943–47. Monthly production data for earlier years are not available.

Mine production of gold, silver, copper, lead, and zinc in States east of the Mississippi River, 1945–49, in terms of recoverable metals

Year	Mines producing		Material sold or treated		Gold (lode and placer)[1]		Silver (lode)[2]	
	Lode	Placer	Crude ore (short tons)	Old tailings (short tons)	Fine ounces	Value	Fine ounces	Value
1945	111		[3] 6,335,831	3,820,946	1,857	$64,995	106,044	$75,409
1946	108	5	[3] 5,451,340	3,763,871	1,432	50,120	79,266	64,047
1947	120		[3] 6,293,007	3,411,070	1,997	69,895	137,780	124,691
1948	110		[3] 6,544,541	2,349,877	2,479	86,765	101,171	91,565
1949	119	2	7,535,840	2,089,155	1,967	68,845	101,612	91,964

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	42,856	$11,571,120	10,069	$1,731,868	180,322	$37,052,932	$50,496,324
1946	34,513	11,182,212	11,127	2,425,686	161,876	35,472,314	49,194,379
1947	36,875	15,487,500	9,026	2,599,488	181,792	42,810,934	61,092,508
1948	42,025	18,238,850	10,706	3,832,748	177,787	47,696,879	69,946,807
1949	32,955	12,984,270	9,755	3,082,580	156,298	40,560,934	56,788,593

[1] Includes placer gold as follows: 1945, none; 1946, 22 ounces; 1947–48, none; 1949, 27 ounces.
[2] No placer silver was produced during 1945–49.
[3] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Gold.—Gold was recovered from mines in Georgia, North Carolina, Pennsylvania, Tennessee, and Vermont during 1949. Total output in terms of recoverable metal was 1,967 fine ounces, a 21-percent decrease from 1948. In Georgia one lode and one placer mine produced 18 ounces of gold, and in North Carolina one lode and one placer mine produced 13 ounces of gold. All other gold reported produced in States east of the Mississippi was a byproduct of copper-bearing ores

and was recovered from slimes from electrolytic refining of the copper. These byproduct sources were, as in 1948, from magnetite-pyrite-chalcopyrite ore from the Cornwall mine, Lebanon County, Pa.; copper ore from the Elizabeth mine, Orange County, Vt.; and copper-iron-zinc ore from the Tennessee Copper Co. mines, Polk County, Tenn. The reported production of placer gold in 1949 was 27 fine ounces. No placer gold was reported in 1948. A portion of the placer gold was sold on the open market in its natural state for as much as $50 per ounce.

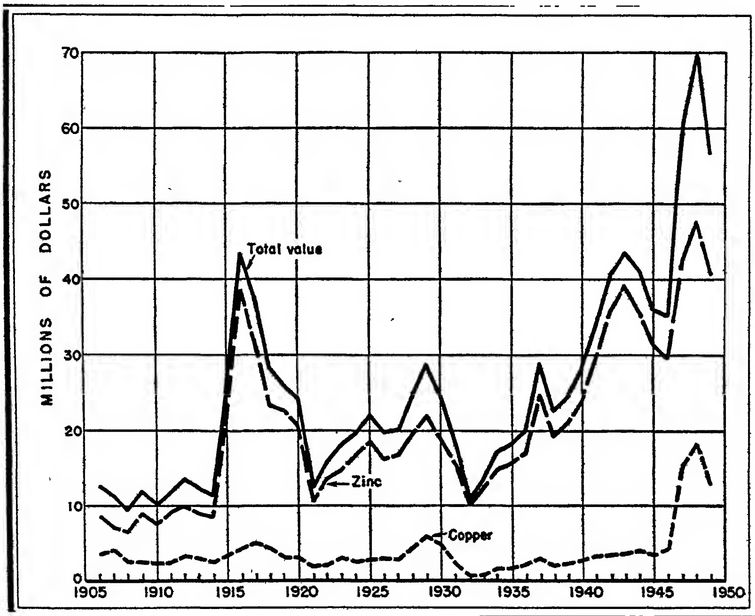

FIGURE 1.—Value of mine production of zinc and copper and total value of gold, silver, copper, lead, and zinc in States east of the Mississippi River, 1906–49.

Mine production of gold, silver, copper, lead, and zinc in States east of the Mississippi River, 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	207	8,356	3,328	787	14,858
February	180	9,021	3,174	635	14,064
March	220	8,692	3,343	824	15,554
April	189	9,163	3,128	879	14,915
May	210	9,023	1,742	857	14,434
June	180	8,924	1,597	839	14,953
July	162	8,265	1,588	736	12,592
August	180	8,318	1,795	806	14,054
September	153	8,100	3,316	922	13,304
October	23	7,809	3,106	890	8,988
November	102	7,905	3,198	881	8,993
December	161	8,096	3,640	699	9,589
Total: 1949	1,967	101,612	32,955	9,755	156,298
1948	2,479	101,171	42,025	10,706	177,787

Mine production of gold in the Southern Appalachian States, 1799–1949

State	Period	Fine ounces	Value	State	Period	Fine ounces	Value
Alabama	1830–1949	49,495	$1,198,985	Tennessee	1831–1949	21,595	$503,455
Georgia	1830–1949	870,660	18,088,947	Virginia	1828–1949	167,558	3,577,509
Maryland	[1] –1949	6,102	163,940				
North Carolina	1799–1949	1,164,601	24,328,298	Total	1799–1949	2,598,812	55,423,259
South Carolina	1829–1949	318,801	7,562,125				

[1] Year of first production not recorded.

Silver.—There was little change from 1948 in the output of silver from mines in States east of the Mississippi River. Production was 101,612 fine ounces in 1949 and 101,171 fine ounces in 1948. All the silver was recovered as a byproduct from copper, lead, or zinc-lead ores from mines in Illinois, New York, Pennsylvania, Tennessee, and Vermont. The silver content of these ores is usually very low and often is not assayed.

Copper.—Copper production in States east of the Mississippi River in 1949 was 22 percent less than in 1948. The chief reasons for this decrease were: The closing of the Isle Royal Copper Co. mines in Michigan in December 1948; temporary cessation of underground mining and part of the reclamation work of the Calumet & Hecla Consolidated Copper Co. in Michigan because of the drop in the price of copper; and the loss of production from the Cornwall mine of the Bethlehem Steel Co. in Pennsylvania during the steel strike, October 1–31.

Producing companies in the States east of the Mississippi River, in order of output in 1949, were: The Calumet & Hecla Consolidated Copper Co. in Michigan; the Tennessee Copper Co. in Tennessee; Bethlehem Steel Co. in Pennsylvania; Vermont Copper Co. in Vermont; Quincy Mining Co. in Michigan; and Copper Range Co. in Michigan.

Lead.—Lead, chiefly a byproduct of fluorspar or zinc mining, was produced in Illinois, Kentucky, New York, Tennessee, Virginia, and Wisconsin during 1949. Total output in 1949, in terms of recoverable metal, was 9,755 short tons, a 9-percent decrease from 1948. Reduced output from the Austinville mine of the New Jersey Zinc Co. in Virginia, the largest producer of lead in the region, accounted for most of the decrease. Also the total output of mines in both Kentucky and Wisconsin recorded a slight decrease in the production of lead in 1949 compared with 1948. A small increase in total lead production was reported for Illinois, New York, and Tennessee. The principal producers, in order of rank within the region, were the New Jersey Zinc Co. in Virginia, Ozark-Mahoning Co. in Southern Illinois, St. Joseph Lead Co. in New York, and the Tri-State Zinc Co. in Northern Illinois.

Zinc.—Mines east of the Mississippi River supplied 26 percent of the total United States production of domestic zinc in 1949. Output from the region was 12 percent less than in 1948. The major portion of this decrease can be attributed to the loss of production from the New Jersey Zinc Co. mines in Sussex County, N. J., during the labor

strike at the Palmerton, Pa., zinc smelter (the mines were idle from September 27, 1949, to January 26, 1950). Mines in Virginia and Wisconsin also reported decreased production of zinc in 1949. However, a larger share of the zinc output credited to Wisconsin in 1948 was from ore mined and stockpiled during 1942–47 but not credited as production until the year milled. If only current production of zinc from mines in Wisconsin were considered for 1948 and for 1949, the 1949 output would be greater by 27 percent. Output from mines in Kentucky, Illinois, New York, and Tennessee increased in 1949.

MINING INDUSTRY

There were virtually no strikes at base-metal mines in the region east of the Mississippi River; however, the steel strike and the strike at Palmerton, Pa., zinc smelter materially affected the production of zinc and copper and to a lesser degree the lead, gold, and silver output. Virtually all the major mines producing in 1948 continued to operate in 1949. A notable exception was the copper mine of the Isle Royal Copper Co. in Michigan, which was closed in December 1948. The decline in prices for lead and zinc resulted in cessation of mining operations of the Vinegar Hill Zinc Co. and several smaller operators in Wisconsin. The decline in the price of copper caused the Calumet & Hecla Consolidated Copper Co. to cease operations for a short time at most of its copper properties in Michigan. The price decline also affected other large operators to the extent that they either curtailed production or did not proceed with so extensive plans for expansion or development. Production was reported from 119 lode mines and 2 placer mines in 1949 compared with 110 lode mines and no placer operations in 1948.

New operations in 1949 include the Eagle-Picher Mining & Smelting Co. zinc-lead mine in northern Illinois and the Calumet & Hecla Consolidated Copper Co. zinc-lead mine in Wisconsin. Production of zinc and lead also was reported from two mines in the prospecting or development stage near Embreeville, Washington County, Tenn., and one near Winchester, Frederick County, Va. Development of the New Jersey Zinc Co. zinc properties near Friedensville, Pa., was continued.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

METALLURGIC INDUSTRY

During 1949 virtually all the ore and old tailings were treated at concentration mills at or near the mines, and the product was shipped to smelters, refineries, or oxide plants. Of the total of 9,624,995 short tons of material treated during the year, 7,535,840 tons were ore and 2,089,155 tons old tailings. The ore tonnage includes 1,536,728 tons of magnetite-pyrite-chalcopyrite ore produced in Pennsylvania, which had not been included in reporting for previous years. This tonnage is also reported in the chapter on iron ore in this volume. In 1948 a total of 8,894,418 tons of ore and tailings, exclusive of pyrite ore from

Ore sold or treated in States east of the Mississippi River in 1949, with content in terms of recoverable metals

Source	Ore and tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Gold ore:						
Georgia	5	1				
North Carolina	5	3				
Total	10	4				
Copper ore:						
Michigan	3,542,868			19,506		
Tennessee	1,109,915	171	41,833	[1] 13,449		(2)
Vermont	222,636	120	27,446	(1)		
Total	4,875,419	291	69,279	[1] 32,955		(2)
Magnetite-pyrite-chalcopyrite ore: Pennsylvania	1,536,728	1,645	10,827	(1)		
Zinc ore:						
Illinois	175,054				30	7,634
Kentucky	18,595				58	643
New Jersey	341,058					50,984
New York	153,811		1,200		102	11,821
Tennessee	1,064,193					[2] 29,726
Virginia	101					4
Wisconsin	37,889				52	1,833
Total	1,790,701		1,200		242	[2] 102,645
Zinc-lead ore:						
Illinois	418,036		3,128		3,211	10,448
Kentucky	43,992				129	292
New York	350,294		17,178		1,215	26,152
Tennessee	4,200				204	62
Virginia	431,742				3,313	13,162
Wisconsin	136,073				805	3,462
Total	1,384,337		20,306		8,877	53,578
Lead ore:						
Illinois	37,000				583	75
Tennessee	800				53	
Total	37,800				636	75
Grand total: 1949	9,624,995	1,940	101,612	32,955	9,755	156,298
1948	[3] 8,894,418	2,479	101,171	42,025	10,706	177,787

[1] Data for copper in Pennsylvania (from magnetite-pyrite-chalcopyrite ore) and Vermont included with Tennessee; Bureau of Mines not at liberty to publish separate figures.
[2] Zinc from copper ore included with that from zinc ore; Bureau of Mines not at liberty to publish separate figures.
[3] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Pennsylvania, was produced. Of this total, 6,544,541 tons were crude ore and 2,349,877 tons tailings. In 1948 all the crude ore except 9,910 tons and all the tailings were treated in concentration mills at or near the mines. About 10 tons of gold ore in 1949 and about 36 tons in 1948 were treated by amalgamation.

The methods of treatment used in the mills and other operating details, including the tonnage and grade of concentrates produced at some mills, are given in the Review by States that follows.

Active smelters and refineries in States east of the Mississippi River that treated primary materials include copper plants at Hubbell and Hancock, Mich., Carteret, N. J., Laurel Hill, N. Y., Copperhill, Tenn., Baltimore, Md., and Barber, N. J.; lead plants at Barber, N. J., East Chicago, Ind., and Federal Hill, Ill.; zinc plants at Hillsboro, Fairmont City, La Salle, East St. Louis, and Depue, Ill., Donora, Palmerton, and Josephtown, Pa., Columbus, Ohio, and Meadowbrook, W. Va.

Mine production of gold, silver, copper, lead, and zinc in States east of the Mississippi River in 1949, by States, in terms of recoverable metals

State	Mines producing		Ore and tailings (short tons)	Gold			Silver (all lode)	
	Lode	Placer		Fine ounces		Total value	Fine ounces	Value
				Lode	Placer			
Georgia	1	1	5	1	17	$630	----------	----------
Illinois	28	----------	[1] 630,090	----------	----------	----------	3,128	$2,831
Kentucky	13	----------	[1] 62,587	----------	----------	----------	----------	----------
Michigan	9	----------	3,542,868	----------	----------	----------	----------	----------
New Jersey	2	----------	341,058	----------	----------	----------	----------	----------
New York	3	----------	504,105	----------	----------	----------	18,378	16,633
North Carolina	1	1	5	3	10	455	----------	----------
Pennsylvania	1	----------	1,536,728	1,645	----------	57,575	10,827	9,799
Tennessee	12	----------	2,179,108	171	----------	5,985	41,833	37,861
Vermont	1	----------	222,636	120	----------	4,200	27,446	24,840
Virginia	2	----------	431,843	----------	----------	----------	----------	----------
Wisconsin	46	----------	173,962	----------	----------	----------	----------	----------
Total: 1949	119	2	9,624,995	1,940	27	68,845	101,612	91,964
1948	110	----------	[2] 8,894,418	2,479	----------	86,765	101,171	91,565

State	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Georgia	----------	----------	----------	----------	----------	----------	$630
Illinois	----------	----------	3,824	$1,208,384	18,157	$4,502,936	5,714,151
Kentucky	----------	----------	187	59,092	935	231,880	290,972
Michigan	19,506	$7,685,364	----------	----------	----------	----------	7,685,364
New Jersey	----------	----------	----------	----------	50,984	[3] 14,443,062	[3] 14,443,062
New York	----------	----------	1,317	416,172	37,973	9,417,304	9,850,109
North Carolina	----------	----------	----------	----------	----------	----------	455
Pennsylvania	(4)	(4)	----------	----------	----------	----------	[4] 67,374
Tennessee	[4] 13,449	[4] 5,298,906	257	81,212	29,788	7,387,424	[4] 12,811,388
Vermont	(4)	(4)	----------	----------	----------	----------	[4] 29,040
Virginia	----------	----------	3,313	1,046,908	13,166	3,265,168	4,312,076
Wisconsin	----------	----------	857	270,812	5,295	1,313,160	1,583,972
Total: 1949	32,955	12,984,270	9,755	3,082,580	156,298	40,560,934	56,788,593
1948	42,045	18,238,850	10,706	3,832,748	177,787	47,696,879	69,946,807

[1] Excludes lead-bearing material mined with fluorspar and from which some lead was recovered as a byproduct of the mining and milling of the fluorspar.
[2] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.
[3] Estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added.
[4] Data for copper in Pennsylvania and Vermont included with Tennessee; Bureau of Mines not at liberty to publish separate figures.

REVIEW BY STATES

GEORGIA

A total production of 18 fine ounces of gold was reported in 1949 for the State. One ounce from the Brand mine of the Cooperative Mining & Development Co. was sold during the year, although the mine was not operating. The remaining production was from the Josephine placer in Lumpkin County. Part of the output was sold to the United States Mint at Philadelphia and the remainder as natural gold specimens.

The Bureau of Mines published a report on the Chestatee copper and pyrite deposit.[1]

[1] Kline, M. H., and Beck, W. A., Investigation of Chestatee Copper and Pyrite Deposit, Lumpkin County, Ga.: Bureau of Mines Rept. of Investigations 4397, 1949, 12 pp.

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ILLINOIS

Northern Illinois.—During 1949 five mines operated in Jo Daviess County. Production totaled 345,474 tons of crude ore, from which 22,342 tons of zinc concentrates containing 12,433 tons of recoverable zinc and 1,617 tons of lead concentrates containing 1,184 tons of recoverable lead were obtained. Tri-State Zinc., Inc., operated its Bautsch, Heer, and Black Jack mines. The Bautsch mine operated throughout the year, whereas the Heer mine operated from January through July, and the Black Jack during January and February. The ore is concentrated in the company Gray mill by jigs and flotation. An inclined adit, 1,625 feet long, to the Bautsch mine was finished July 1. The ore is now hauled by Diesel trucks direct from the mine through the adit to the mill. Daily capacity of the Gray mill was increased from 600 to 850 tons by the addition of a new crushing plant which began operations on July 1. An inclined adit to the Black Jack mine was begun in October 1949. By the end of the year 290 feet of open-cut and 100 feet of adit had been completed. Churn drilling at the Bautsch mine totaled 3,554 and at the Black Jack mine 4,743 feet for the year.

The Eagle-Picher Mining & Smelting Co. operated the Graham and Snyder mines throughout the year. Both company and custom ore was treated in the new 70-ton-per-hour Graham central mill, which began shipments in April 1949.

During the year Vinegar Hill Zinc Co. completed milling the ore from Northern Illinois and Wisconsin mines that was stockpiled by the Office of Metals Reserve (Reconstruction Finance Corporation) during 1942–47. Although 1948 Minerals Yearbook stated that the remainder of this material was milled in 1948, milling was not completed until 1949. Of the residue of stockpiled ore finally milled in 1949, Illinois is credited with the production of 118 tons of zinc and 5 tons of lead (recoverable metal) obtained from 1,627 tons of zinc-lead ore.

The Bureau of Mines published reports on the Royal Princess zinc-lead deposit and the Gray zinc-iron deposits.[2]

Southern Illinois.—Production of zinc, lead, and silver was reported from 23 mines in the district during 1949 compared with 16 during 1948. However, output of all three metals decreased from that of 1948 owing chiefly to a drop in demand for fluorspar and the resulting decrease in production at the larger operations.

KENTUCKY

Total output of recoverable zinc and lead produced chiefly as a byproduct or coproduct with fluorspar was 935 and 187 short tons, respectively, during 1949. Zinc output increased 296 tons and lead output decreased 29 tons from that of 1948. The fluorspar-lead-zinc operations are situated principally in Crittenden and Livingston Counties. The principal producer was the Ozark-Mahoning Co.,

[2] Holt, Stephen P., Investigation of Royal Princess Zinc-Lead Deposit, Jo Daviess County, Ill.: Bureau of Mines Rept. of Investigations 4386, 1949, 13 pp.
Kenworthy, H., Metallurgical Investigations of the Recovery of Zinc and Iron Sulfides From the Gray Zinc-Iron Deposit, Galena, Ill.: Bureau of Mines Rept. of Investigations 4442, 1949, 12 pp.

which operated the Babb, Commodore, and Goering mines. Development at the three mines included 80 feet of shaft and 3,494 feet of diamond drilling. All the ore is treated at the company mill at Rosiclare, Ill. The Alco Lead Corp. operated the Mineral Ridge mine. The U. S. Coal & Coke Co., Fluorspar Division, operated the Tabb No. 1 and concentrated the ore at its fluorspar mill at Mexico, Ky. The company also shipped some ore from the Lafayette mine for treatment at the Ozark-Mahoning Co. mill at Rosiclare. Other fluorspar producers shipped small quantities of ore containing zinc, lead, and fluorspar to the Ozark-Mahoning mill. The Alcoa Mining Co. continued development of the Hutson zinc mine in Livingston County.

The Bureau of Mines published a report on the K. T. Dome mine.[3]

MICHIGAN

Mines in Michigan produced 30 percent less copper in 1949 than in 1948. Closing of the Isle Royal Copper Co. mines in December 1948 and suspension of work at underground operations by Calumet & Hecla Consolidated Copper Co. from May 1 through September 1 and at the Tamarack reclamation plant from April 18 through September 1 were the chief reasons for this decrease. Calumet & Hecla Consolidated Copper Co. also reported decreased production for the Lake Linden reclamation plant. The Copper Range Co. and the Quincy Mining Co., the only other producers in the State, reported slight increases in production in 1949.

Underground mines operated by the Calumet & Hecla Consolidated Copper Co. during 1949 were the Ahmeek, Douglass, Iroquois, Kearsarge, Peninsula, Allouez, Centennial, and Seneca No. 2. Ore from these mines is treated in the 6,000-ton-per-day Ahmeek mill. While in operation the mill was run three shifts, 7 days per week. The Lake Linden and Tamarack reclamation plants of the company also were run on a three-shift, 7-day-week basis. Extracts from the company annual report follow:

During 1949 the copper industry was subjected to violent fluctuations, both in price and in demand. When the demand for consumer goods fell off, copper fabricators and manufacturers found themselves with excessive inventories. For a time sales of copper virtually stopped, and in the second quarter of the year the price dropped from 23½ cents to 16 cents per pound. As inventories were worked off, however, the price gradually advanced, reaching 17⅝ cents in July. In November the price moved up to 18½ cents, and remained there until the end of the year. Prices of copper and brass tubing closely followed the market quotations for copper and zinc.

Our Company was gravely affected by the recession. The marginal nature of our copper mines made it impossible to produce copper for 16 cents per pound. Copper which had been produced or purchased at a cost of more than 16 cents had to be disposed of at a substantial loss. Profit that had been made in the first quarter was wiped out in the second quarter.

Effective May 1 and continuing throughout the year, the officers of the Company took a voluntary salary reduction of 10 percent. On May 1 the mines were shut down, many employees were laid off, and salaries were reduced. The mines were kept unwatered and necessary maintenance was carried on. The smelter continued operating at a curtailed rate, smelting concentrates and a small intake of secondary material.

[3] Beck, William A., Investigation of the K. T. Dome Zinc-Lead Mine, Owen and Henry Counties, Ky.: Bureau of Mines Rept. of Investigations 4575, 1949, 10 pp.

Resumption of mining operations at the Calumet Division on September 6 was made possible by a wage reduction of 15 cents per hour, reluctantly suggested by the Company and accepted by the employees. With the wage and salary reductions and other rigid operation economies in effect, production from the mines continued without substantial loss throughout the balance of the year. The results at the year end were encouraging, and we are hopeful that copper prices which will permit our mines to earn a profit will prevail in 1950.

Treatment of tailings was continued by the Quincy Mining Co. in its reclamation plant at Mason, Mich., throughout the year. The concentrates made were refined in the company smelter at Hancock, Mich.

Mining of the East Vein of the Champion mine was carried on throughout the year by the Copper Range Co. The ore was treated at the company mill at Freda, and the concentrates were shipped to the Calumet & Hecla Consolidated Mining Co. smelter for refining. Further exploration of the White Pine ore body was begun by the company in May. The company annual report makes the following statement concerning the White Pine ore body:

Six holes were completed for a total of 8,128 feet. The result has been to add at least 50 million tons of positive plus probable ore to our reserves. The total reserves as of the year end were 249,610,000 tons carrying 22.3 pounds of copper per ton, including 156,770,000 tons of parting shale ore averaging 24.3 pounds of copper per ton. The results of this exploration work further confirm the remarkable uniformity of the mineralization and the occurrence of ore under a large area. Drilling is continuing, and the results to date have added substantially to the reserves as given above.

NEW JERSEY

New Jersey mines produced 33 percent less zinc in 1949 than in 1948. The Franklin and Sterling Hill mines in Sussex County were shut down from September 27, 1949, to January 26, 1950, owing to a labor strike at the Palmerton, Pa., smelter. In reported value, zinc produced was worth 30 percent less in 1949 than in 1948.

The value of the New Jersey output of zinc given in the tables of this chapter is the combined value of the zinc recoverable in both metal and oxide after freight, haulage, smelting, and manufacturing charges have been added.

NEW YORK

In New York State three mines—two producing zinc and lead and one producing zinc only—continued to operate throughout 1949. Output of ore increased 9 percent over 1948 to 504,105 short tons. Production of zinc, in terms of recoverable metal, increased about 10 percent and lead 7 percent.

The total silver contained in lead concentrates shipped during 1949 was greater than in 1948. However, lead refiners reported 2 percent less recovered. Whether silver is or is not recovered from soft lead depends chiefly on the quantity of silver in the lead and the demand for desilverized lead.

All three mines are in St. Lawrence County. The St. Joseph Lead Co. operated the Balmat and the Edward mines. Zinc, lead, and iron concentrates are produced from the Balmat, which is operated through one 40° inclined shaft 2,907 feet long. The ore is treated in a company 1,200-ton flotation mill. Development at the mine during 1949

included 2,237 feet of drifts and 48,450 feet of diamond drilling, 9,387 feet underground drilling, and 39,063 feet from the surface. The Edwards mine, operated through two shafts—one 1,560 feet vertical from the surface and one underground 1,895 feet along a 42° slope—produces zinc ore which is concentrated in a company 600-ton-per-day capacity all-flotation mill. Development at the mine during the year included 337 feet of shaft, 1,167 feet of drifts, and 8,290 feet of diamond drilling.

The Hyatt mine was operated by the Universal Exploration Co. through a single shaft, 450 feet deep. Ore produced is milled in the company 200-ton-per-day flotation plant, and zinc and lead concentrates are made. Development at this mine during the year included 200 feet of drift.

A report on the Parker & Webb zinc deposits was published by the Bureau of Mines.[4]

NORTH CAROLINA

A test shipment of gold ore from a prospect on Jack Edwards property in Rutherford County was made by James I. Gantt. Dry weight of the shipment was 5 short tons. It assayed 0.56 ounce of gold per ton. About 10 ounces of placer gold were sold to the United States Mint at Philadelphia, Pa.

Reports on the Virgilina copper district in Virginia and North Carolina and on the Scarlet copper mine, Randolph County, N. C., were published by the Bureau of Mines.[5]

PENNSYLVANIA

The Bethlehem Steel Co. operated its Cornwall mine in Lebanon County continuously throughout the year. However, output of ore decreased 15 percent and production of gold, silver, and copper, in terms of recoverable metal, decreased 25, 21, and 26 percent, respectively, from that of 1948. Magnetite-pyrite-chalcopyrite ore is mined. Concentration is done in the company mill by magnetic separation and flotation. Copper concentrate made is shipped to Laurel Hill, N. Y. The mine is worked as both an open pit and underground operation. Capacity of the magnetic separation plant is 6,000 tons, flotation plant 2,200 tons, and sintering plant 2,400 tons per day. Operation of the mill is conducted on a three-shift, 5-day-week basis.

Development of the New Jersey Zinc Co. zinc mine in the Friedensville district was continued. The shaft was about 30 percent complete at the end of the year.

Zinc smelters at Donora, Josephtown, and Palmerton, Pa., treat most of the zinc concentrates produced in New York, Pennsylvania, and Tennessee, as well as large tonnages from other States and from foreign countries. The smelter at Palmerton was idle from September 26, 1949, to January 26, 1950, as the result of a dispute between labor and management.

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[4] Hermance, H. P., and Sanford, Robert S., Investigation of Parker & Webb Zinc Deposits, St. Lawrence County, N. Y.: Bureau of Mines Rept. of Investigations 4417, 1949, 31 pp.

[5] Newberry, A. W., Roes, Alford, Robertson, Almon F., Dahners, L. A., and Cohen, C. J., Investigation of the Virgilina Copper District, Virginia and North Carolina: Bureau of Mines Rept. of Investigations 4384, 1949, 12 pp.

Kline, M. H., and Dosh, H. G., Investigation of the Scarlet Copper Mine, Randolph County, N. C.: Bureau of Mines Rept. of Investigations 4492, 1949, 10 pp.

Reports on the Albright Farm lead-zinc deposit and the Pickering Creek lead-zinc deposits were published by the Bureau of Mines.[6]

TENNESSEE

Production was reported from 12 mines operated by 5 companies in 1949 compared with 11 mines operated by 3 companies in 1948. All five metals were produced. Gold and silver were recovered as a byproduct of copper ores. Production of gold in terms of recoverable metal increased about 10 percent and silver about 5 percent; however, copper production decreased 3 percent from 1948. Zinc output was nearly the same as 1948. No lead production was reported in 1948, but 257 tons were recovered in 1949 from development and mining in Washington County near Embreeville.

The American Zinc Co. of Tennessee continued operation of the Grasselli, Jarnagin, and Mossy Creek mines in Jefferson County and the Mascot No. 2 mine in Knox County. All were operated throughout 1949 except the Mossy Creek mine, which was operated from January 1 to June 17. All ore is concentrated in the company mill at Mascot, Tenn. Initial concentration is made in a heavy-medium plant, followed by jigging and flotation. Jig and flotation concentrates are marketed after drying. Several sizes of limestone are also produced and sold. Development at the mines in 1949 included 2,123 feet of drifts, 12,760 feet of diamond drilling, and 1,605 feet of churn drilling at the Mascot No. 2; 2,453 feet of drifts, 2,411 feet of diamond drilling, and 6,612 feet of churn drilling at the Grasselli; 463 feet of drifts and 1,788 feet of churn drilling at the Jarnagin; and 280 feet of drift at the Mossy Creek.

In Polk County the Tennessee Copper Co. operated the Burra Burra, Calloway, Mary, Eureka, and Boyd mines throughout 1949. Development during the year included 1,140 feet of shaft, 10,845 feet of drifts, 3,304 feet of raises, and 16,866 feet of diamond drilling. Sublevel stoping and blast-hole drilling with diamond drills are employed in mining. Blasting is done with electric caps connected with instantaneous fuse. Ore is concentrated in two mills, the London with a capacity of 2,100 tons per day and the Isabella with a capacity of 1,200 tons per day. A bulk concentrate of iron, zinc, and copper is made first, then zinc, and copper concentrates, in that order, are recovered, the tailings being the iron concentrate. The zinc concentrate is shipped to the American Zinc Co. at East St. Louis, and the copper concentrate is smelted at the company smelter. The copper is cast as shot copper for manufacture of copper sulfate and other copper-bearing insecticides. The traces of gold and silver in the crude ore accumulate in slimes from the manufacture of copper sulfate. These slimes are recirculated through the smelter, and the gold and silver content builds up in the circuit. Occasionally blister copper from the smelter, relatively high in gold and silver, is cast into pigs weighing about 330 pounds each. These pigs are shipped to the Laurel Hill, N. Y., electrolytic plant, where the gold and silver are recovered.

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[6] Reed, Donald F., Investigation of the Albright Farm Lead-Zinc Deposit, Blair County, Pa.: Bureau of Mines Rept. of Investigations 4422, 1949, 7 pp.
Reed, Donald F., Investigation of Pickering Creek Lead-Zinc Deposits, Chester County, Pa.: Bureau of Mines Rept. of Investigations 4451, 1949, 11 pp.

Products of the Tennessee Copper Co. at Copperhill include sulfuric acid, liquid SO_2 (less than 100 p. p. m. water), granulated slag, iron sinter, copper sulfate, insecticides, blister copper, and zinc concentrates.

The Universal Exploration Co. operated the Davis-Bible group of claims and 800-ton- (875 to 900 tons maximum per 24 hours) per-day mill throughout 1949 except for the period October 7 to November 21. The exceptionally high grade zinc concentrates are shipped to the Donora, Pa., smelter. Tailings from the mill are sold as agricultural lime. Development in the mine during 1949 included 236 feet of shaft, 1,321 feet of drifts, 8,779 feet of diamond drilling, and 2,533 feet of churn drilling.

In Washington County the Appalachian Zinc Co. produced a small quantity of zinc-lead ore, and the Cove Development Co. produced a small quantity of lead ore during the latter half of the year.

The Bureau of Mines published reports on the Tennessee Zinc Co. property, Bumpus Cove, Unicoi County; the Eve Mills zinc deposit, Monroe County; and the Idol and Dalton zinc deposits, Grainger County.[7]

VERMONT

Gold, silver, and copper were produced by the Vermont Copper Co. from the Elizabeth mine and dumps and the Ely dumps in Orange County. Operation was steady throughout 1949, and production of copper increased 35 percent, gold 15 percent, and silver 10 percent over 1948. The ore, containing chalcopyrite and pyrrhotite with a small quantity of gold and silver, was concentrated in the company 500-ton flotation mill. Several improvements were made to the mill in 1949. Concentrates are shipped to the Phelps-Dodge Corp. smelter and refinery at Laurel Hill, N. Y.

The Bureau of Mines published a report on the Ely mine copper deposit in Orange County.[8]

VIRGINIA

Output of lead and zinc decreased 30 and 17 percent, respectively, in Virginia in 1949 from that of 1948. However, the major producer operated continuously throughout the year. No copper, gold, or silver production was recorded in 1949.

The Austinville zinc-lead mine and 2,000-ton-per-day mill operated throughout 1949. Mining was on a two-shift, 6-day-week basis. Trammers and repairmen only worked on the third shift. The mill operated three shifts, 5 days a week.

During the latter part of the year the Timberville Mining Co. produced a small quantity of ore from its property in Frederick County. The ore was concentrated by the American Zinc Co. of Tennessee at the Mascot, Tenn., mill.

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[7] Clayton, A. B., and Sayrs, R. L., Investigation of the Tennessee Zinc Co. Property, Bumpus Cove, Unicoi County, Tenn.: Bureau of Mines Rept. of Investigations 4390, 1949, 14 pp.
Sayrs, Richard L., Investigation of Eve Mills Zinc Deposit, Monroe County, Tenn.: Bureau of Mines Rept. of Investigations 4411, 1949, 5 pp.
Sayrs, Richard L., and Clayton, Austin B., Investigation of Idol and Dalton Zinc Deposits, Grainger County, Tenn.: Bureau of Mines Rept. of Investigations 4497, 1949, 4 pp.

[8] Hermance, H. P., Newmann, G. L., and Mosier, McHenry, Investigation of Ely Mine Copper Deposit, Orange County, Vt.: Bureau of Mines Rept. of Investigations 4395, 1949, 11 pp.

The Bureau of Mines published reports on the Valzinco lead-zinc mine and the Allah-Copper lead-zinc mine.[9]

WISCONSIN

During 1949 Wisconsin mines produced and treated 153,055 tons of ore and old tailings containing in terms of recoverable metal 813 tons of lead and 4,108 tons of zinc. In 1948 Wisconsin mines produced and treated 97,595 tons of ore and old tailings containing, in terms of recoverable metal, 577 short tons of lead and 3,224 tons of zinc. These data show that the output of lead and zinc in Wisconsin in 1949 increased 41 and 27 percent, respectively, over 1948.

In addition, 20,907 tons of ore mined in Wisconsin before 1948 were treated in 1949. Most of this ore was from the stockpile of the Office of Metals Reserve. The remainder was ore stocked by the Vinegar Hill Zinc Co. This ore contained, in terms of recoverable metal, 44 tons of lead and 1,187 tons of zinc. The 1948 Minerals Yearbook incorrectly reported that all of the material in the OMR stockpile had been treated by the close of 1948. All the ore owned by OMR for account of the Vinegar Hill Zinc Co. was purchased by the Vinegar Hill Zinc Co. in 1948, but that company did not complete milling until 1949. For data on that portion of OMR stocks originating from mines in Illinois, see the Illinois section of this chapter.

Over 50 percent of the ore produced in Wisconsin was treated or received final concentration at the Vinegar Hill Zinc Co. custom mill near Platteville. Some operators make a rough concentrate on tables or jigs, producing a high-grade lead concentrate and an intermediate concentrate of lead and zinc, or, if the ore contains very little lead, produce only an intermediate-grade zinc concentrate. Lead concentrates are usually sold to local ore buyers, and the zinc or zinc-lead product is shipped to Vinegar Hill Zinc Co. for further concentration.

The Vinegar Hill Zinc Co. operated from January 1 to August 4, when milling operations ceased chiefly because of the low price for zinc. Many of the small operators ceased mining when this mill was closed. Some then shipped ore to the Eagle-Picher Mining & Smelting Co. Graham mill near Galena, Ill.

Opening of a mine near Shullsburg in Lafayette County, Wis., by the Calumet & Hecla Consolidated Copper Co. in the latter part of 1949 promised to be a major factor in the lead and zinc industry in the State. Development of the mine and construction of a 1,200-ton mill were carried on throughout the year. Concentrates were first shipped to a smelter in September. Ore treated during the year was chiefly from development.

Wisconsin's largest zinc and lead producer during 1949 was the Andrews mine, operated by the Cuba Mining Co. Ore from this property was treated in a 25-ton-per-hour gravity mill, producing a high-grade lead concentrate and an intermediate-grade zinc-lead concentrate. This latter concentrate was treated further at the Vinegar Hill Zinc Co. custom mill. According to the management, the mine

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[9] Grosh, Wesley, A., Investigation of Valzinco Lead-Zinc Mine, Spotsylvania County, Va.: Bureau of Mines Rept. of Investigations 4403, 1949, 7 pp.
Grosh, Wesley A., Investigation of the Allah-Copper Lead-Zinc Mine, Louisa County, Va.: Bureau of Mines Rept. of Investigations 4604, 1949, 6 pp.

was closed July 9 because of the low price of zinc. The Dodgeville Mining Co. operated the Dodgeville No. 1 and No. 2 mines from January 1 to October 19. This company also ceased operation because of the low price of zinc. It was the second largest producer of lead and zinc in the State. The ore was treated in the company mill by gravity and flotation methods. The company completed 17,500 feet of prospect churn drilling in 1949.

Other producers, in order of output, include: Meekers Grove Mining Co., George M. Baker Mining Co., Whitechurch & Farr, Kittoe Mining Co., L. G. & W. Mining Co., Murray & Richards, and the Benton Milling Co. Other individuals or companies made small shipments of ore.

Reports of investigations of several Wisconsin zinc and lead deposits were published by the Bureau of Mines in 1949.[10]

OTHER STATES

No production of gold, silver, copper, lead, or zinc was reported in other States in the region during 1949. The Bureau of Mines published a report on the copper-bearing pyrite ores in Clay County, Ala.[11]

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[10] Cummings, Alvin M., Investigation of Vial Zinc Mine, Iowa County, Wis.: Bureau of Mines Rept. of Investigations 4385, 1949, 7 pp.
Apell, G. A., Investigation of the Nigger Jim Lead Diggings, Lafayette County, Wis.: Bureau of Mines Rept. of Investigations 4372, 1949, 9 pp.
Kelly, James V., Investigation of Rodham Mine Zinc and Lead Ores, Lafayette County, Wis.: Bureau of Mines Rept. of Investigations 4446, 1949, 6 pp.
Cummings, A. M., Sampling the Kennedy Zinc Tailing Pile, Lafayette County, Wis.: Bureau of Mines Rept. of Investigations 4468, 1949, 7 pp.
Apell, G. A., Investigation of the M. C. Zinc Mine, Lafayette County, Wis.: Bureau of Mines Rept. of Investigations 4485, 1949, 8 pp.

[11] Pallister, H. D., and Thoenen, J. R., Investigation of Copper-Bearing Pyrite Ores, Pyriton, Clay County, Ala.: Bureau of Mines Rept. of Investigations 4494, 1949, 15 pp.

Idaho

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. Needham and Paul Luff

GENERAL SUMMARY

GOLD was the only major nonferrous metal to attain an increased output in Idaho in 1949. Lead, zinc, and silver—the principal metals mined in Idaho—each declined and copper as well. The gold output increased from 58,454 fine ounces in 1948 to 77,829 in 1949 (a 33-percent gain); but the silver output declined from 11,448,875 fine ounces to 10,049,257 (a 12-percent loss); copper from 1,624 short tons to 1,438 (an 11-percent loss); lead from 88,544 tons to 79,299 (a 10-percent loss); and zinc from 86,267 tons to 76,555 (an 11-percent loss). The lead output again exceeded the zinc output, but only by 4 percent. The total value of the five metals dropped from $67,758,290 in 1948 to $56,429,796 in 1949 (a 17-percent loss). The total value of the gold was $2,724,015—5 percent of the State total value; silver, $9,095,085—16 percent; copper, $566,572—1 percent; lead, $25,058,484—44 percent; and zinc, $18,985,640—34 percent. In 1949 the State remained the largest producer of silver and zinc in the United States and the second-largest producer of lead (exceeded only by Missouri). About 91 percent of the State silver production, 81 percent of the copper, 94 percent of the lead, and 97 percent of the zinc came from the Coeur d'Alene region of Shoshone County; the remaining silver, copper, lead, and zinc came largely from the Warm Springs district in Blaine County.

About 69 percent of the State gold production in 1949 came from a lode mine in the Yellow Pine district, Valley County; the remainder came largely from dredging operations in the Elk City district, Idaho County; Boise Basin district, Boise County; and Yankee Fork district, Custer County.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1945–49, and total, 1863–1949, in terms of recoverable metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	116	27	3,139,286	17,780	$622,300	8,142,667	$5,790,341
1946	139	71	2,882,187	42,975	1,504,125	6,491,104	5,244,812
1947	183	99	3,717,697	64,982	2,274,370	10,345,779	9,362,930
1948	194	78	3,981,846	58,454	2,045,890	11,448,875	10,361,810
1949	171	82	3,057,075	77,829	2,724,015	10,049,257	9,095,085
1863–1949			(1)	8,042,014	184,609,893	552,329,323	387,851,818

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	1,548	$417,960	68,447	$11,772,884	83,463	$19,196,490	$37,799,975
1946	1,038	336,312	59,987	13,077,166	71,507	17,447,708	37,610,123
1947	1,640	688,800	78,944	22,735,872	83,069	20,102,698	55,164,670
1948	1,624	704,816	88,544	31,698,752	86,267	22,947,022	67,758,290
1949	1,438	566,572	79,299	25,058,484	76,555	18,985,640	56,429,796
1863–1949	112,489	34,917,267	6,187,171	735,371,376	1,539,563	273,263,985	1,616,014,339

[1] Figure not available.

Gold.—The output of recoverable gold in Idaho in 1949 was 77,829 ounces, 19,375 ounces more than in 1948. The gain was entirely from lode mines, as the output of gold from placer properties decreased 5,698 ounces. Gold from lode mines in 1949 was 62,751 fine ounces compared with 37,678 fine ounces in 1948, and that from placer properties was 15,078 fine ounces compared with 20,776 fine ounces. The Yellow Pine lode mine in Valley County, worked by the Bradley Mining Co., continued to be by far the largest gold producer in Idaho, and its output in 1949 was nearly double that in 1948; it was followed by a bucket-line dredge at Elk City worked by the Warren Dredging Corp; a bucket-line dredge at Idaho City worked by the Idaho-Canadian Dredging Co.; a lode property at Atlanta worked by Talache Mines, Inc.; and a dragline dredge on Jordan Creek worked by Jordan Placers, Inc. Of the total gold produced in Idaho in 1949, nearly 74 percent came from gold ore, 13 percent from bucket-line dredging, 6

percent from dragline dredging, and most of the remainder from zinc-lead ore. Four bucket-line dredges and 7 dragline dredges treated about 3,000,000 cubic yards of gravel in 1949 and recovered 14,707 fine ounces of gold and 4,334 fine ounces of silver.

Gold produced at placer mines in Idaho, 1945–49, by classes of mines and by methods of recovery

Class and method	Mines producing	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average value per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucket-line dredges					
1945	1	250,000	1,593	$55,755	$0.223
1946	7	3,766,746	17,448	610,680	.162
1947	8	3,381,351	14,112	493,920	.146
1948	5	3,139,168	14,969	523,915	.167
1949	4	2,332,576	10,234	358,190	.154
Dragline dredges:					
1945					
1946	6	364,260	2,272	79,520	.218
1947	4	577,000	2,939	102,865	.178
1948	2	400,000	1,071	37,485	.094
1949	2	406,000	1,409	49,315	.121
Suction dredges:					
1945–46					
1947	5	19,590	103	3,605	.184
1948	3	1,200	20	700	.583
1949	2	11,765	54	1,890	.161
Nonfloating washing plants: [1]					
1945–46					
1947	8	444,490	2,232	78,120	.176
1948	5	457,570	4,204	147,140	.322
1949	5	259,500	3,064	107,240	.413
Gravel hydraulically handled:					
Hydraulic:					
1945	6	14,600	109	3,815	.261
1946	10	37,100	248	8,680	.234
1947	9	32,560	152	5,320	.163
1948	4	32,600	189	6,615	.203
1949	5	14,800	87	3,045	.206
Small-scale hand methods: Wet:					
1945	17	5,000	59	2,065	.413
1946	43	7,350	133	4,655	.633
1947	58	10,607	218	7,630	.719
1948	54	11,087	307	10,745	.969
1949	60	20,866	218	7,630	.366
Underground placers:					
Drift:					
1945	3	933	8	280	.300
1946	5	2,567	22	770	.300
1947	7	2,333	20	700	.300
1948	5	620	16	560	.903
1949	3	1,330	12	420	.316
Grand total placers:					
1945	[2] 27	270,533	1,769	61,915	.229
1946	71	4,178,023	20,123	704,305	.169
1947	99	4,467,931	19,776	692,160	.155
1948	78	4,042,245	20,776	727,160	.180
1949	[2] 82	3,046,837	15,078	527,730	.173

[1] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."

[2] A mine using more than one method of recovery is counted but once in arriving at total for all methods.

Silver.—Idaho's output of recoverable silver in 1949 was 10,049,257 ounces, 1,399,618 ounces less than that in 1948. The loss resulted mainly from curtailment of operations during the latter half of the year at zinc-lead-silver mines caused by declines in the prices of lead

and zinc and from a strike at the Bunker Hill lead smelter at Bradley from August 20 to November 14. However, the State remained the largest producer of silver in the United States—a place it has held since 1933. The Coeur d'Alene region produced 9,146,146 fine ounces of silver in 1949 or 91 percent of the State total silver; the remainder came largely from the Warm Springs, Yellow Pine, and Bayhorse districts. Of the State total silver, silver ore yielded 42 percent, zinc-lead ore and old tailings 42 percent, lead ore 15 percent, and gold ore most of the remainder. The recovery of silver from silver ore decreased 1,485,378 ounces, that from zinc-lead ore 299,622 ounces, and that from gold ore 141,685 ounces, but that from lead ore increased 535,517 ounces.

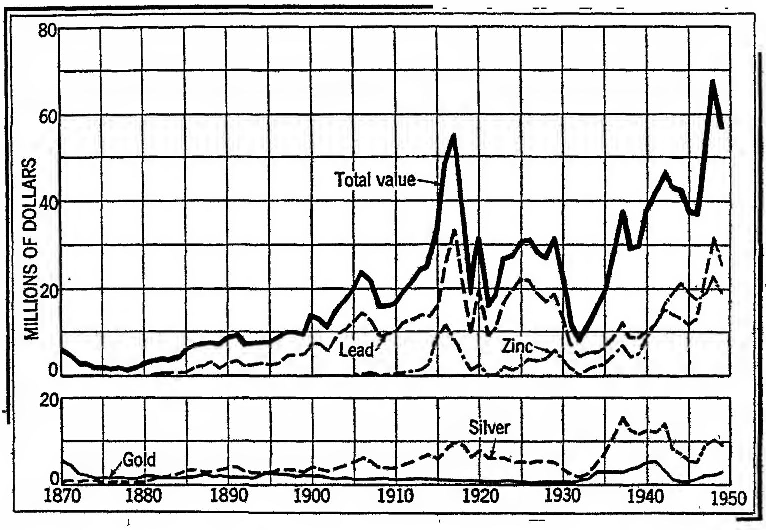

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc, and total value of gold, silver, copper, lead, and zinc in Idaho, 1870–1949. The value of copper has been less than $2,000,000 annually, except in a few years.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	2,337	840,600	100	8,165	7,455
February	2,632	987,300	110	7,040	6,285
March	3,934	1,047,200	145	8,470	7,430
April	6,312	1,128,600	150	8,115	7,245
May	7,160	1,237,000	185	8,030	7,110
June	8,452	991,000	140	7,455	7,200
July	8,542	886,000	130	6,640	6,495
August	7,230	995,500	135	6,915	6,535
September	8,987	321,000	60	3,305	4,315
October	8,687	194,500	40	2,775	3,745
November	7,622	484,053	81	5,029	5,863
December	6,934	994,504	162	7,360	6,877
Total: 1949	77,829	10,049,257	1,438	79,299	76,555
1948	58,454	11,448,875	1,624	88,544	86,267

Twelve mines—the Sunshine, Bunker Hill & Sullivan, Polaris, Page, Silver Dollar, Triumph, Sherman, Silver Syndicate, Silver Summit, Lucky Friday, Star, and Morning—produced 83 percent of the silver output of the State in 1949. Six properties (Sunshine, Polaris, Silver Syndicate, Silver Dollar, Sunshine Consolidated, and Metropolitan) near Kellogg, operated by the Sunshine Mining Co., produced 4,742,708 ounces of silver in 1949, or 47 percent of the State total.

Copper.—The output of copper in Idaho declined to 1,438 short tons in 1949, 186 tons less than that in 1948. About 72 percent of the State copper output in 1949 was recovered as a byproduct in the treatment of zinc-lead ore and silver ore from mines in the Coeur d'Alene region; the remainder was recovered largely from zinc-lead ore produced in the Warm Springs district.

The Sunshine mine near Kellogg in the Coeur d'Alene region continued to be the largest producer of copper in Idaho. It was followed by the Triumph, Bunker Hill & Sullivan, Polaris, and Silver Dollar properties.

Lead.—In 1949 the mines in Idaho produced 79,299 short tons of recoverable lead, 9,245 tons less than in 1948. The loss resulted principally from curtailment of operations during the latter half of the year at zinc-lead-silver mines, caused by a drop in the prices of lead and zinc and by a strike at the Bunker Hill lead smelter at Bradley from August 20 to November 14. However, the lead output again exceeded the zinc output, but in the Coeur d'Alene region, where most of Idaho's lead and zinc is produced, it was the reverse—the zinc output exceeded the lead output. In 1949, 94 percent of the State total lead came from the Coeur d'Alene region; most of the remainder was produced in the Warm Springs, Bayhorse, Alder Creek, Clark Fork, and Texas districts. Zinc-lead ore and old tailings (1,851,268 tons) from the Coeur d'Alene region yielded 77 percent of the State total lead; and lead ore and silver ore, chiefly from the Coeur d'Alene region, yielded 18 percent. The remainder came largely from zinc-lead ore in the Warm Springs and Bayhorse districts, lead ore in the Bayhorse, Alder Creek, Clark Fork, Texas, and Port Hill districts,

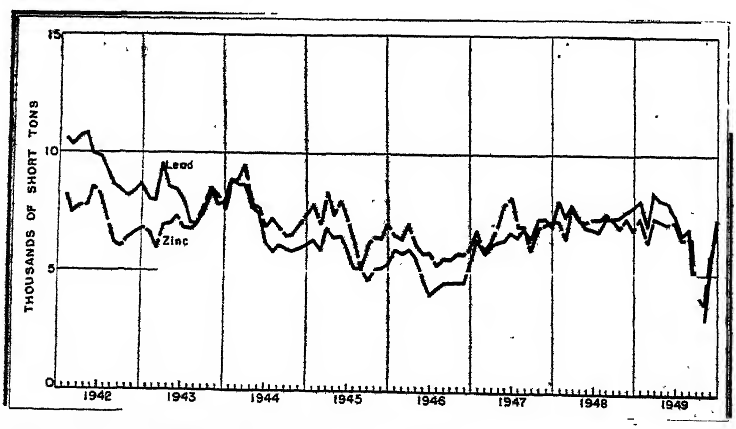

FIGURE 2.—Mine production of lead and zinc in Idaho, 1942–49, by months, in terms of recoverable metals.

and old zinc slag in the Coeur d'Alene region. Lead recovered from zinc-lead ore and old tailings decreased 14,319,114 pounds, that from silver ore 2,582,329 pounds, that from zinc ore and old slag 978,756 pounds, and that from lead ore 618,297 pounds.

The Bunker Hill & Sullivan mine at Kellogg was by far the largest producer of lead in Idaho in 1949, although its output decreased nearly 11 percent from 1948. In 1949 the combined lead output of the six largest producing mines (each producing more than 6,000,000 pounds)—the Bunker Hill & Sullivan, Page, Star, Morning, Sherman, and Sidney—was 101,317,987 pounds or 64 percent of the State total. Other important producers in 1949 were the Triumph, Bunker Hill & Sullivan mill tailing dump, Dayrock, Frisco, Tamarack, and Sunshine properties.

Zinc.—Idaho's output of recovered zinc declined to 76,555 short tons in 1949, 9,712 tons less than that in 1948. This loss resulted from the same causes that reduced the silver and lead outputs. About 97 percent of the State total zinc in 1949 came from the Coeur d'Alene region and most of the remainder from the Warm Springs district. Zinc-lead ore and old tailings concentrated yielded 93 percent of the State total zinc; old zinc slag smelted and fumed, 3 percent; and zinc ore concentrated and lead ore concentrated, 3 percent.

Ten properties (each producing more than 5,000,000 pounds of zinc)—the Star, Page, Morning, Sidney, Bunker Hill & Sullivan, Frisco, Amazon-Carlisle, Spokane-Idaho, Highland-Surprise, and Tamarack—produced 80 percent of the State total zinc in 1949.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1949, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Ada		1	12	$420		
Adams	2		5	175	326	$295
Blaine	17		2,218	77,630	498,728	451,374
Boise	6	24	4,830	169,050	4,350	3,937
Bonner	10		137	4,795	70,268	63,596
Bonneville		2	28	980		
Boundary	1		2	70	8,068	7,302
Butte	1				21	19
Camas	4		226	7,910	3,928	3,555
Cassia	1				10	9
Clark	1					
Clearwater		2	5	175		
Custer	23	2	3,134	109,690	128,216	116,042
Elmore	7	6	3,148	110,180	15,250	13,802
Gem	1		151	5,285	242	219
Idaho	6	27	7,385	258,475	1,391	1,259
Jerome		1	9	315		
Lemhi	25	8	457	15,995	76,135	68,906
Nez Perce		2	4	140		
Owyhee	3	4	60	2,100	579	524
Shoshone	61	1	2,438	85,330	9,146,146	8,277,724
Twin Falls		1	2	70		
Valley	1	1	53,577	1,875,195	92,439	83,662
Washington	1		1	35	3,160	2,860
Total: 1949	171	82	77,829	2,724,015	10,049,257	9,095,085
1948	194	78	58,454	2,045,890	11,448,875	10,361,810

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1949, by counties, in terms of recoverable metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Ada							$420
Adams	29,000	$5,713					6,183
Blaine	313,400	61,740	4,963,200	$784,186	3,466,100	$429,796	1,804,726
Boise	200	39	3,400	537			173,563
Bonner	2,000	394	602,000	95,116	35,100	4,352	168,253
Bonneville							980
Boundary	1,300	256	390,000	61,620	22,900	2,840	72,088
Butte			24,300	3,839	29,400	3,646	7,504
Camas	1,300	256	44,900	7,094	2,300	285	19,100
Cassia			500	79	600	74	162
Clark	14,400	2,837					2,837
Clearwater							175
Custer	43,000	8,471	3,240,600	512,015	725,900	90,012	836,230
Elmore							123,982
Gem			1,800	284			5,788
Idaho			200	32			259,766
Jerome							315
Lemhi	130,400	25,689	1,023,100	161,650	88,500	10,974	283,214
Nez Perce							140
Owyhee							2,624
Shoshone	2,341,000	461,177	148,304,000	23,432,032	148,739,200	18,443,661	50,699,924
Twin Falls							70
Valley							1,958,857
Washington							2,895
Total: 1949	2,876,000	566,572	158,598,000	25,058,484	153,110,000	18,985,640	56,429,796
1948	3,248,000	704,816	177,088,000	31,698,752	172,534,000	22,947,022	67,758,290

MINING INDUSTRY

Despite an adequate supply of mine labor, Idaho's mining industry suffered a serious setback in 1949, owing to a strike from August 20 to November 14 at the Bunker Hill lead smelter at Bradley, which caused most of the large producing zinc-lead-silver and silver-lead mines in the Coeur d'Alene region to suspend operations. This strike, coupled with continuous declines in the prices of lead and zinc during the second quarter of the year, caused substantial decreases in production of silver, copper, lead, and zinc in 1949 compared with 1948. However, gold production rose from 58,454 fine ounces to 77,829, because the Bradley Mining Co. treated an ore richer in gold from its Yellow Pine mine at Stibnite. The output of zinc-lead ore and old tailings (by far the chief ore output of the State) decreased from 2,824,758 tons to 1,920,206, gold ore from 672,681 tons to 624,083, and zinc ore and old slag from 79,674 tons to 49,401; silver ore increased from 149,691 tons to 175,225, and lead ore from 253,648 tons to 287,664. About 98 percent of the gold ore mined in Idaho in 1949 came from the Yellow Pine mine at Stibnite, Valley County, where the output decreased from 655,682 tons in 1948 to 610,988 tons in 1949, but production of gold in 1949 was nearly double that in 1948. About 78 percent of the silver ore, 99 percent of the zinc ore and old slag, 96 percent of the zinc-lead ore and old tailings, and nearly 86 percent of the lead ore was produced in the Coeur d'Alene region. Placer mining indicated greater activity, but production of gold from this source declined owing to exhaustion of commercial gravel in the Boise Basin district, Boise County, where one bucket-line dredge, operated

for the past 15 years, ceased work in March. Thirteen dredges (7 dragline, 4 bucket-line, and 2 suction) recovered 14,761 fine ounces of gold in Idaho in 1949, compared with 15 dredges (7 dragline, 5 bucket-line, and 3 suction) in 1948 that recovered 20,264 fine ounces of gold.

ORE CLASSIFICATION

Details on ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Idaho in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold ore	33	624,083	57,281	108,613	229	4,050	130
Dry gold-silver ore	4	79	54	1,468	212	1,037	------------
Dry silver ore	21	175,225	320	4,250,576	1,150,956	4,844,976	351,710
Total	58	799,387	57,655	4,360,657	1,151,397	4,850,063	351,840
Copper ore	7	384	10	554	82,510	------------	------------
Lead ore	62	287,664	772	1,475,017	289,911	23,865,407	2,336,052
Lead-copper ore	3	33	2	2,702	2,518	9,713	------------
Zinc ore	4	[1] 49,401	16	14,950	9,480	1,182,480	7,490,088
Zinc-lead ore	59	1,920,206	4,296	4,190,996	1,340,184	128,690,337	142,932,020
Total lode mines	[2] 171	[1] 3,057,075	62,751	10,044,876	2,876,000	158,598,000	153,110,000
Placers	82	------------	15,078	4,381	------------	------------	------------
Total: 1949	253	[1] 3,057,075	77,829	10,049,257	2,876,000	158,598,000	153,110,000
1948	273	[3] 3,981,846	58,454	11,448,875	3,248,000	177,088,000	172,534,000

[1] Includes 22,389 tons of old lead-smelter slag.
[2] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[3] Includes 48,131 tons of old lead-smelter slag.

METALLURGIC INDUSTRY

Of the 3,057,075 tons of ore produced in 1949 in Idaho, 3,011,615 tons (98.5 percent) were treated at milling plants, and the remainder—45,460 tons (1.5 percent)—was shipped crude to smelters.

Milling plants in 1949 treated principally zinc-lead ore and old tailings (1,919,466 tons), gold ore (624,029 tons), lead ore (277,089 tons), silver ore (164,386 tons), and zinc ore (26,575 tons). Current hot zinc slag totaling 81,781 tons was fumed, and 22,389 tons of old dump lead-smelter slag were delivered for smelting and fuming in 1949. Metals recovered from the old dump slag were credited to the Bunker Hill smelter dump, and metals recovered from the hot slag were credited to various producers of the ores and concentrates that contributed during the year to the slag-making material.

The Bunker Hill & Sullivan Mining & Concentrating Co. operated its Bradley lead smelter and refinery on ore and concentrates, chiefly from mines and mills in the Coeur d'Alene region; both plants were closed from August 20 to November 14 owing to a strike. The company also operated its antimony and cadmium plants, 2,000-ton flota-

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tion mill (including a sink-and-float unit), 300-ton tailing-treatment plant for recovery of silver, iron, lead, and zinc from old jig tailings, and 450-ton zinc slag-fuming plant at Bradley. According to the company annual stockholders' report for 1949, the smelter produced 7,224 ounces of gold, 7,528,102 ounces of silver, 22,039 pounds of cadmium, 753 tons of copper, 456 tons of antimony, 8,836 tons of zinc, and 44,571 tons of lead. The slag-fuming plant yielded 12,589 dry tons of deleaded zinc fume and 3,068 dry tons of zinc-lead fume; the production of lead and zinc in 1949 was less than that in 1948 as the plant was closed from August 20 to December 31. The Sullivan Mining Co. operated continuously throughout the year its 150-ton electrolytic zinc plant near Bradley, producing 41,854 tons of high-grade slab zinc and 203 tons of cadmium. In addition, the plant recovered from residues and other byproducts 6,071 tons of zinc, 3,385 tons of lead, 111 tons of copper, 325,917 ounces of silver, and 1,374 ounces of gold. The Bradley Mining Co. operated its 2,000-ton flotation mill at Stibnite, Valley County, continuously on gold-silver-antimony ore from the Yellow Pine mine and completed in August the construction of a smelter at Stibnite for reduction of the antimony and gold concentrates.

Mine production of metals in Idaho in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	1,214	808			
Concentrates smelted	60,704	9,870,960	2,752,716	154,307,482	148,378,476
Ore smelted	833	173,108	123,284	4,290,518	4,731,524
Placer	15,078	4,381			
Total: 1949	77,829	10,049,257	2,876,000	158,598,000	153,110,000
1948	58,454	11,448,875	3,248,000	177,088,000	172,534,000

Gross metal content of Idaho ore treated at mills in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content of mill feed				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	624,629	72,264	146,033	350	4,500	2,050
Dry gold-silver	20	3	75			
Dry silver	164,386	259	4,280,860	1,560,766	5,025,770	595,000
Copper	50		10	3,000		
Lead	277,089	573	1,501,073	379,563	23,985,559	4,675,470
Zinc	26,575	25	11,806	14,000	469,221	4,174,934
Zinc-lead	1,919,466	7,652	4,693,944	2,065,569	146,142,486	165,513,248
Total: 1949	3,011,615	80,776	10,633,801	4,023,248	175,627,536	174,960,702
1948	3,903,188	62,526	12,306,521	4,395,501	201,243,017	199,504,017

Gross metal content of concentrates produced from ores mined in Idaho in 1949, by classes of concentrates smelted

Class of concentrates	Concentrates (short tons)	Gross metal content: Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	25,325	55,828	107,152		1,444	1,168
Dry gold-silver	3	9	186			
Dry silver	1	1	3,160			
Copper	575	33	299,477	152,190	4,563	
Lead	118 562	2,315	4,985,440	1,208,369	143,104,055	16,794,358
Lead-copper	11,624	133	3,888,938	1,116,710	4,863,737	400,000
Zinc	135,006	1,225	527,217	560,731	8,363.672	138,600,998
Zinc-lead	1,470	30	37,909	17,450	777,982	865,247
Dry iron (from zinc-lead ore)	4,335	1,130	21,481	31,354	204,362	106,841
Total: 1949	296,901	60,704	9,870,960	3,086,804	157,319,815	156,768,612
1948	313,663	34,863	11,254,623	3,423,951	172,897,608	172,125,112

Mine production of metals from mills in Idaho in 1949, by counties and by classes of concentrates smelted, in terms of recoverable metals

	Material treated (short tons)	Recoverable in bullion: Gold (fine ounces)	Recoverable in bullion: Silver (fine ounces)	Concentrates smelted and recoverable metal: Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Blaine	52,543			12,148	2,201	488,421	311,564	4,832,382	3,448,947
Boise	77	47	24						
Bonner	10,177			396	4	21,161	1,700	443,660	19,600
Boundary	20,000			285	2	7,250	1,300	350,560	16,031
Camas	463			102	199	808	755	33,711	2,300
Custer	17,153			1,707	34	59,542	11,535	1,306,820	566,855
Elmore	12,139	969	702	348	2,143	14,539			
Gem	200	8	4	10	93	159		1,130	
Idaho	463	166	71	4	11	70		200	
Lemhi	32,729	20	3	1,106	14	55,219	92,045	164,400	
Owyhee	6	4	4	2	7	123			
Shoshone	2,254,673			255,830	2,419	9,128,069	2,333,817	147,174,619	144,324,743
Valley	610,988			24,962	53,576	92,439			
Washington	4			1	1	3,160			
Total: 1949	3,011,615	1,214	808	296,901	60,704	9,870,960	2,752,716	154,307,482	148,378,476
1948	3,903,183	1,608	923	313,663	34,863	11,254,623	3,032,365	169,744,626	162,562,361
BY CLASSES OF CONCENTRATES SMELTED									
Dry gold				25,325	55,828	107,152		1,380	
Dry gold-silver				3	9	186			
Dry silver				1	1	3,160			
Copper				575	33	299,477	144,920	4,434	
Lead				118,562	2,315	4,985,440	1,039,795	140,654,950	13,391,423
Lead-copper				11,624	133	3,888.938	1,003,100	4,767,560	316,000
Zinc				135,006	1,225	527,217	519,542	7,990,229	133,898,375
Zinc-lead				1,470	30	37,909	14,901	761,564	766,428
Dry iron (from zinc-lead ore)				4,335	1,130	21,481	30,458	127,365	6,250
Total 1949				296,901	60,704	9,870,960	2,752,716	154,307,482	148,378,476

Gross metal content of Idaho crude ore shipped to smelters in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content: Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	54	226	451	----------	723	568
Dry gold-silver	59	52	1,405	220	1,436	----------
Dry silver	10,839	151	55,145	5,440	67,589	47,062
Copper	334	10	547	82,307	----------	----------
Lead	10,575	388	99,974	46,338	3,225,214	245,959
Lead-copper	33	2	2,702	3,068	10,181	2,233
Zinc	[1] 22,826	----------	8,888	778	830,971	5,698,216
Zinc-lead	740	4	4,416	1,315	294,123	167,590
Total: 1949	[1] 45,460	833	173,528	139,466	4,430,237	6,161,628
1948	[2] 78,663	1,212	187,599	242,978	7,650,951	13,498,848

[1] Includes 22,389 tons of old lead-smelter slag smelted and fumed.
[2] Includes 48,131 tons of old lead-smelter slag smelted and fumed.

Mine production of metals from Idaho crude ore shipped to smelters in 1949, in terms of recoverable metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Adams	54	5	326	29,000	----------	----------
Blaine	344	17	10,307	1,836	130,818	17,153
Boise	44	59	3,083	200	3,400	----------
Bonner	6,010	133	49,107	300	158,340	15,500
Boundary	48	----------	818	----------	39,440	6,869
Butte	166	----------	21	----------	24,300	29,400
Camas	96	27	3,120	545	11,189	----------
Cassia	3	----------	10	----------	500	600
Clark	35	----------	----------	14,400	----------	----------
Custer	7,979	140	66,768	31,465	1,933,780	159,045
Elmore	11	22	9	----------	----------	----------
Gem	13	50	79	----------	670	----------
Idaho	1	7	60	----------	----------	----------
Lemhi	2,712	367	20,913	38,355	858,700	88,500
Owyhee	3	----------	410	----------	----------	----------
Shoshone	[1] 27,941	6	18,077	7,183	1,129,381	4,414,457
Total: 1949	[1] 45,460	833	173,108	123,284	4,290,518	4,731,524
1948	[2] 78,663	1,207	187,410	215,635	7,343,374	9,971,639
BY CLASSES OF ORE						
Dry gold	54	226	451	----------	670	----------
Dry gold-silver	59	52	1,405	212	1,037	----------
Dry silver	10,839	151	55,145	4,681	62,682	29,610
Copper	334	10	547	80,165	----------	----------
Lead	10,575	388	99,974	34,198	3,111,861	80,006
Lead-copper	33	2	2,702	2,518	9,713	----------
Zinc	[1] 22,826	----------	8,468	440	816,150	4,499,160
Zinc-lead	740	4	4,416	1,070	288,405	122,748
Total 1949	[1] 45,460	833	173,108	123,284	4,290,518	4,731,524

[1] Includes 22,389 tons of old lead-smelter slag smelted and fumed.
[2] Includes 48,131 tons of old lead-smelter slag smelted and fumed.

REVIEW BY COUNTIES AND DISTRICTS

ADAMS COUNTY

Leasing operations at two mines in the Seven Devils district in 1949 produced 54 tons of carbonate copper ore—41 tons from the Helena claim and 13 tons from the South Peacock claim.

BLAINE COUNTY

Little Wood River (Muldoon) District.—Operations at the Eagle Bird mine from April to November by Garfield Mines, Inc., produced 566 tons of ore containing 2 ounces of gold, 5,402 ounces of silver, 1,618 pounds of copper, 93,778 pounds of lead, and 54,157 pounds of zinc.

Mineral Hill and Camas District.—The Apache Mines Co. completed constructing a 100-ton flotation mill at the Bullion-Red Elephant property near Hailey in 1949 and during the latter half of the year treated 2,930 tons of zinc-lead ore. The rest of the district output was 70 tons of silver-lead ore produced from the Croesus, D. Day, and Queen Bess properties and 66 tons of zinc-lead ore from the Snoose and Queen Bess mines.

Warm Springs District.—Output of zinc-lead-silver ore from the Triumph mine of the Triumph Mining Co., the most important producer of gold, silver, copper, lead, and zinc in southern Idaho, increased from 35,552 tons in 1948 to 49,014 tons in 1949. All the ore, containing 4,515 ounces of gold, 545,795 ounces of silver, 434,795 pounds of copper, 5,737,157 pounds of lead, and 4,214,653 pounds of zinc, was shipped to milling plants in Utah, where it was reduced to 4,446 tons of lead concentrate, 4,180 tons of iron concentrate, and 3,044 tons of zinc concentrate. In addition, lessees shipped 102 tons of zinc-lead ore and 40 tons of silver ore from the Triumph mine dumps. The remainder of the district output was 56 tons of zinc-lead ore produced from the Boston-Idaho and Homestake properties and 25 tons of silver-lead ore from the Boulder, Hyndman Peak, Lead Metals, and Leilani properties.

BOISE COUNTY

Boise Basin District (Centerville, Placerville, Idaho City, Pioneerville, Quartzburg).—Suspension in March—after 15 years' operation—of bucket-line dredging on Granite Creek near Centerville by Baumhoff-Marshall, Inc., resulted in a marked decline in the output of gold from the Boise Basin district in 1949. In 1949 two bucket-line dredges produced 4,656 fine ounces of gold compared with 11,109 fine ounces in 1948. The chief producer in 1949 was the Idaho-Canadian Dredging Co., which operated its 6-cubic-foot bucket-line dredge on Moores Creek near Idaho City from March 15 to October 7, treating 1,150,000 cubic yards of gravel. Ground sluicing recovered 54 fine ounces of gold and 12 fine ounces of silver and suction dredging 11 ounces of gold and 1 ounce of silver from various claims. The lode output was 42 tons of silver ore produced from the Golden Age mine and 52 tons of gold ore from the Come-Back and Julianna mines.

Summit Flat District.—About 15 tons of gold ore were produced in 1949 from the Jessie and Rock Creek mines and treated in amalgamation mills.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1949, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Ada County: Highland		1			12	12							$420
Adams County: Seven Devils	2		54	5		5	326		326	29,000			6,183
Blaine County:													
Lava Creek	1		10				569		569	100			535
Little Wood River (Muldoon)	2		567	2		2	5,445		5,445	1,300	90,900	44,000	25,072
Mineral Hill and Camas	5		3,066	29		29	24,265		24,265	1,900	195,200	151,300	72,953
Sawtooth	1		7				147		147	100			153
Warm Springs	8		49,237	2,187		2,187	468,302		468,302	310,000	4,677,100	3,270,800	1,706,013
Boise County:													
Boise Basin	3	21	94	68	4,721	4,789	3,086	1,243	4,329	200	3,400		172,109
Garden Valley		1			1	1							35
Grimes Pass	1		12	6		6							210
South Fork of Payette River		2			2	2							70
Summit Flat	2		15	32		32	21		21				1,139
Bonner County:													
Clark Fork	3		9,528	3		3	19,873		19,873	1,100	574,700	22,300	111,876
Lakeview	2		6,593	132		132	48,531		48,531	600	10,300	6,100	51,044
Pend d'Oreille	5		66	2		2	1,864		1,864	300	17,000	6,700	5,333
Bonneville County: Mount Pisgah		2			28	28							980
Boundary County: Port Hill	1		20,048	2		2	8,068		8,068	1,300	390,000	22,900	72,088
Butte County: Dome	1		166				21		21		24,300	29,400	7,504
Camas County:													
Beaver Creek	1		486	216		216	937		937	900	38,400	2,300	14,937
Little Smoky	2		72	7		7	2,991		2,991	400	6,500		4,058
Skeleton Creek	1		1	3		3							105
Cassia County: Stokes	1		3				10		10		500	600	162
Clark County: Birch Creek	1		35							14,400			2,837
Clearwater County: Pierce		2			5	5							175
Custer County:													
Alder Creek	6		3,901	52		52	28,173		28,173	23,200	883,100	155,000	190,638
Bayhorse	10		19,971	46		46	87,130		87,130	16,800	2,146,600	359,000	467,456
Boulder	1		1,027	10		10	5,983		5,983	1,700	165,500	162,000	52,337
Seafoam	2		182	17		17	3,560		3,560	1,000	43,800	49,900	17,122
Yankee Fork	4	2	51	49	2,960	3,009	1,464	1,906	3,370	300	1,600		108,677
Elmore County:													
Bear Creek	2		25	23		23	11		11				815
Black Warrior	1		(1)	2		2							70
Middle Boise	3	6	12,124	3,106	14	3,120	15,239		15,239				122,992
Pine Grove	1		1	3		3							105
Gem County: West View (Pearl)	1		213	151		151	242		242		1,800		5,788

Idaho County:													
Burgdorf-Marshall Lake	1	4	11	15	94	109	64	21	85				3,892
Camp Howard		1			6	6							210
Castle Creek		1			4	4							140
Dixie	1		40	56		56	21		21				1,979
Elk City		5			6,621	6,621		1,085	1,085				232,717
Florence and French Creek		1			1	1							35
Lower Salmon River		3			55	55		10	10				1,934
Moose Creek		1			11	11							385
Orogrande		5			17	17							595
Salmon River		4			12	12							420
Ten Mile	3	1	393	111	379	490	53	74	127		200		17,297
Warren	1	1	20	2	1	3	63		63				162
Jerome County: Snake River		1			9	9							315
Lemhi County:													
Birch Creek	1		18				74		74		6,100		1,031
Blue Wing	1		32,243	13		13	54,249		54,249	88,800	123,400		86,544
Eureka	3	1	202	17	1	18	115		115	30,000			6,644
Gaw Creek		1			2	2							70
Gibbonsville	1	1	2	2	41	43				100			1,525
Junction	4		61				538		538	100	26,300		4,662
Mackinaw		3			9	9							315
Mineral Hill	1		7	67		67	31		31				2,373
Newsome Creek		1			2	2							70
Nicholia	2		1,031	4		4	3,991		3,991	900	363,700	87,400	72,232
Rattlesnake Creek	1		395	1		1	1,117		1,117	1,000	49,000		8,985
Spring Mountain	3		52	2		2	422		422	1,700	14,700	1,100	3,246
Texas	5		1,351	270		270	15,524		15,524	7,600	438,500		94,280
Yellow Jacket	3	1	79	25	1	26	74		74	200	1,400		1,237
Nez Perce County: Snake River		2			4	4							140
Owyhee County:													
Carson or French	2	2	6	11	46	57	127	42	169				2,148
Castle Creek	1		3				410		410				371
Snake River		1			1	1							35
Steele		1			2	2							70
Shoshone County:													
Beaver	8		141,550	110		110	88,311		88,311	74,000	4,435,800	11,475,000	2,222,110
Evolution	13		415,332	288		288	5,126,062		5,126,062	1,325,000	11,214,100	5,315,500	7,341,400
Hunter	6		364,451	322		322	648,544		648,544	217,700	26,425,300	47,883,400	10,753,861
Lelande	12		180,443	179		179	402,046		402,046	84,000	14,577,100	11,136,300	4,070,768
Placer Center	8		168,005	117		117	234,008		234,008	55,100	8,899,100	6,186,500	2,399,923
Saint Joe	1		31	1		1	10		10	1,600			359
Summit	2	1	500	24	13	37	231		231	600	20,200	19,000	7,170
Yreka	11		1,012,302	1,384		1,384	2,646,934		2,646,934	583,000	82,732,400	66,723,500	23,904,333
Twin Falls County: Snake River		1			2	2							70
Valley County:													
South Fork of Salmon River		1			1	1							35
Yellow Pine	1		610,988	53,576		53,576	92,439		92,439				1,958,822
Washington County: Washington	1		4	1		1	3,160		3,160				2,895
Total Idaho	171	82	3,057,075	62,751	15,078	77,829	10,044,876	4,381	10,049,257	2,876,000	158,598,000	153,110,000	56,429,796

[1] Less than 1 ton.

BONNER COUNTY

Clark Fork District.—Three mines, Hope, Lawrence, and Whitedelf—produced 9,528 tons of ore in 1949, containing 5 ounces of gold, 22,248 ounces of silver, 2,000 pounds of copper, 648,950 pounds of lead, and 49,060 pounds of zinc. The Hope Silver-Lead Mines, Inc., treated 7,500 tons of lead ore in its 150-ton flotation mill, but milling of ore ceased May 2 owing to the drop in the price of lead. In addition, 71 tons of silver-lead ore were shipped direct to a smelter. Lessees operated the Whitedelf mine all year, treated 1,877 tons of lead ore in a 50-ton flotation mill, and shipped 7 tons of similar ore to a smelter. Lessees also worked the Lawrence mine and shipped 73 tons of silver-lead ore to a smelter.

Lakeview District.—The Lakeview Lease operated the Weber mine the last half of the year and shipped 5,793 tons of high-siliceous silver ore to the smelter at Tacoma, Wash.; and 800 tons of zinc-lead-silver ore produced from the property of the Idaho-Lakeview Mines Co. were treated by flotation.

Pend d'Oreille District.—Output in 1949 comprised 43 tons of zinc-lead ore produced from the Gold Coin mine, 11 tons of silver-lead ore from the Little Senator and Red Cliff claims, 5 tons of silver ore from the Brown Bear and Katherine claims, and 7 tons of old mill cleanings recovered from the Talache mill site.

BONNEVILLE COUNTY

Hydraulicking and sluicing at the Golden Queen and Stapleton claims in the Mount Pisgah district recovered 28 fine ounces of gold.

BOUNDARY COUNTY

During the summer months the Continental Mining Co. treated lead ore and old tailings from the Idaho-Continental property, 27 miles west of Porthill. About 15,000 tons of old tailings were treated in a 500-ton heavy-medium separation plant; the resulting lead middling and 5,000 tons of lead ore were treated in a 100-ton flotation mill. The mill yielded a total of 285 tons of concentrates, which contained 2 ounces of gold, 7,250 ounces of silver, 1,538 pounds of copper, 356,637 pounds of lead, and 20,000 pounds of zinc. In addition, 32 tons of zinc-lead ore and 16 tons of lead ore were shipped direct to a smelter.

BUTTE COUNTY

C. A. Dye worked the Sentinel mine near Howe in the Dome district a few months in 1949 and shipped 166 tons of zinc-lead ore to a smelter in Utah.

CAMAS COUNTY

Beaver Creek District.—Lessees (J. R. Davies & Sons) operated the Princess-Blue Ribbon mine near Fairfield in 1949, treated 463 tons of zinc-lead-gold ore in a gravity-flotation mill, and shipped 23 tons of gold-lead ore to a smelter.

Little Smoky District.—Output in 1949 was 60 tons of silver-lead ore produced from the King of the West mine and 12 tons of gold-silver-lead ore from the Smoky Bullion mine.

CLARK COUNTY

Output in 1949 was 35 tons of copper ore produced from the Valley View mine in the Birch Creek district.

CUSTER COUNTY

Alder Creek District.—In 1949 six mines in the Alder Creek district produced 3,901 tons of ore, which contained 52 ounces of gold, 28,273 ounces of silver, 30,586 pounds of copper, 925,448 pounds of lead, and 209,523 pounds of zinc. The principal output was 3,171 tons of lead-silver ore and 405 tons of zinc ore from the Homestake mine near Mackay operated by the White Knob Mining Co. The rest of the district output was 256 tons of lead ore from the Champion, George Washington, Horseshoe, and Sky View properties and 69 tons of copper ore from the Empire mine.

Bayhorse District.—The output of the Bayhorse district in 1949 was 19,971 tons of ore containing 60 ounces of gold, 91,039 ounces of silver, 24,268 pounds of copper, 2,351,872 pounds of lead, and 656,570 pounds of zinc. Zinc-lead ore from the Clayton mine, owned by the Clayton Silver Mines, continued to be the most important production in the district. The company reported that 14,502 tons of ore were treated in its 120-ton flotation mill, which yielded 817 tons of lead concentrate and 334 tons of zinc concentrate. The concentrates contained 17 ounces of gold, 46,772 ounces of silver, 9,300 pounds of copper, 1,076,943 pounds of lead, and 401,450 pounds of zinc. According to the annual stockholders' report of the company for 1949, the south ore shoot on the 400 level was found to be larger and of higher lead content than that mined above the 300 level. The large north ore shoot has been located on the 400 level, but its width and length are undetermined. The ore reserves should be greatly increased in 1950.

The remainder of the district output comprised 3,208 tons of lead ore from the Red Bird mine, 2,167 tons of lead-silver ore from the Ellis, McGregor, Saturday, Silver Rule, South Butte, and Turtle properties, 88 tons of high-grade lead-copper-silver ore from the Ramshorn mine, and 6 tons of zinc-lead ore from the Zodiac claim.

Boulder District.—Livingston Mines, Inc., operated its mine near Clayton all year and shipped 1,027 tons of ore containing 15 ounces of gold, 6,632 ounces of silver, 2,244 pounds of copper, 186,684 pounds of lead, and 195,666 pounds of zinc to reduction plants in Utah.

Seafoam (Greyhound) District.—Lessees operated the Mountain King mine during the summer months and shipped 170 tons of ore containing 12 ounces of gold, 3,992 ounces of silver, 1,215 pounds of copper, 49,112 pounds of lead, and 58,894 pounds of zinc. The rest of the district output was 12 tons of gold ore produced from the Parkin group.

Yankee Fork District.—Placer gold continued to be the most important output in the Yankee Fork district. Jordan Placers, Inc., operated its dragline and nonfloating washing plant on Jordan Creek from May 15 to October 28 and treated 230,000 cubic yards of gravel, which yielded 2,957 fine ounces of gold and 1,907 fine ounces of silver. The lode output of the district was mainly 47 tons of gold-silver ore produced from the Altura and Lucky Boy properties.

ELMORE COUNTY

Bear Creek (Rocky Bar) District.—In 1949 two mines—Empire and Good Luck—in the Bear Creek district produced 25 tons of gold ore.

Middle Boise (Atlanta) District.—Gold ore from the Boise-Rochester-Monarch group at Atlanta continued to be the principal production in the Middle Boise district. The Talache Mines, Inc., operated the group and its 400-ton amalgamation and concentration mill throughout the year. The Company reported that 12,104 tons of ore were milled in 1949, which yielded 3,102 ounces of gold and 15,233 ounces of silver, compared with 10,370 tons of ore milled in 1948, which yielded 2,563 ounces of gold and 11,227 ounces of silver.

GEM COUNTY

Gold ore from the Dewey property at Pearl (West View district) was the only output in 1949 in Gem County. The Gem State Consolidated Mines, Inc., operated the property all year, constructed a 25-ton amalgamation and concentration mill, treated 200 tons of gold ore, and shipped 13 tons of similar ore. The ore yielded 151 ounces of gold, 242 ounces of silver, 1,906 pounds of lead, and 1,691 pounds of zinc.

IDAHO COUNTY

Burgdorf-Marshall Lake District.—Placer gold continued to be the chief production in the Burgdorf-Marshall Lake district. Hydraulicking and sluicing at the Golden Rule claim recovered 45 fine ounces of gold and 11 fine ounces of silver, and suction dredging at the Laughing Water (Ruby Meadows) group recovered similar quantities of gold and silver. Other placer producers were the Rock Creek and Secesh claims.

Dixie District.—George Grebe continued to work the Mammoth mine and recovered 56 fine ounces of gold and 21 fine ounces of silver from treating 40 tons of ore by amalgamation.

Elk City District.—All output in 1949 was placer gold and silver from five properties. The principal producer was the Warren Dredging Corp., which operated a 4-cubic-foot bucket-line dredge on American River from February 17 to December 19; 1,056,576 cubic yards of gravel were treated, yielding 5,446 fine ounces of gold and 875 fine ounces of silver. A dragline and floating washing plant were operated also on American River by the Tyee Mining Co., which treated 350,000 cubic yards of gravel. H. & H. Mines operated a 2-cubic-foot bucket-line dredge on Red Horse Creek in May and June and recovered 132 fine ounces of gold and 29 fine ounces of silver. The remainder (50 ounces) of the district gold output came from the Hawk and Summers Dream placers.

Lower Salmon River District.—Sluicing at three properties near Keuterville recovered 55 fine ounces of gold and 10 fine ounces of silver. The principal producers were the Sunshine and Dickerson placers.

Ten Mile District.—In 1949 one placer and three lode properties were worked in the Ten Mile district. South Fork Placers operated a dragline and floating washing plant on the South Fork of the Clearwater River from July 10 to October 20 and recovered 379 fine ounces of gold and 74 fine ounces of silver. The rest of the district output

was 111 ounces of gold, 53 ounces of silver, and 200 pounds of lead recovered from treating 393 tons of gold ore from the Bob, Haystack, and Lone Pine mines near Golden.

LEMHI COUNTY

Blue Wing District.—The 150-ton concentrator (destroyed by fire in December 1947) at the Ima mine at Patterson was rebuilt in 1948 by the Bradley Mining Co. The mill began operating in January 1949 and during the year treated 32,243 tons of ore containing 2.028 ounces of silver to the ton and 0.507 percent tungsten (WO_3), as well as a little copper and lead. Lead-copper-silver concentrate (1,066 tons) was shipped to smelters in Utah and tungsten concentrate (225 tons) to various destinations.

Eureka District.—Output in 1949 was mainly 194 tons of copper ore produced from the old Pope Shenon mine near Salmon.

Gibbonsville District.—The principal production in the Gibbonsville district in 1949 was 37 ounces of gold cleaned up from former dredging operations.

Junction District.—In 1949 four mines—Blue Lead, Galena, Leona, and Owl & Owl—in the Junction district produced 61 tons of ore containing 538 ounces of silver, 123 pounds of copper, 27,101 pounds of lead, and 775 pounds of zinc.

Mineral Hill District.—Output in 1949 was 6 tons of mill cleanings (gold) recovered from the Gold Hill mill and 1 ton of high-grade gold ore produced from the Monolith mine near Shoup.

Nicholia District.—Asa W. Reid operated the Viola mine all year and shipped 527 tons of ore to smelters in Utah; the ore contained 4 ounces of gold, 3,530 ounces of silver, 1,100 pounds of copper, 283,527 pounds of lead, and 89,243 pounds of zinc. The rest of the district output was 504 tons of old slag (containing largely lead and zinc) shipped from the dump at Nicholia.

Rattlesnake Creek District.—Leasing operations at the Twin Peaks mine 21 miles south of Salmon produced 395 tons of lead ore; most of it was treated in a flotation mill.

Spring Mountain District.—Output in 1949 was principally 34 tons of old slag containing silver, copper, lead, and zinc and 15 tons of lead-copper-silver ore produced from the Mikado claim near Gilmore.

Texas District.—Joe Hamilton operated his Hill Top mine near Gilmore all year and shipped 1,038 tons of ore containing 258 ounces of gold, 12,738 ounces of silver, 7,743 pounds of copper, 296,575 pounds of lead, and 60,000 pounds of zinc. The remainder of the district output was largely 280 tons of oxide lead-silver ore produced from the Latest Out mine.

Yellow Jacket District.—Output in 1949 was mainly old tailings (70 tons) containing gold and silver from the Yellow Jacket property near Forney.

OWYHEE COUNTY

Carson or French (Silver City) District.—In 1949 a dragline and a concentration plant were used by a lessee to recover gold at the Lewis placer property; about 10,000 cubic yards of gravel were treated, which yielded 42 fine ounces of gold and 41 fine ounces of silver. The

rest of the district output was mainly 5 tons of gold ore produced from the Perseverance mine.

SHOSHONE COUNTY—COEUR D'ALENE REGION

The drop in the prices of lead and zinc in 1949, coupled with a strike at the Bunker Hill smelter from August 20 to November 14, resulted in substantial decreases in the output of each metal in the Coeur d'Alene region (Shoshone County)—the chief source of silver, copper, lead, and zinc in Idaho. By the middle of June the prices of lead and zinc had declined so low that some operators working on low-grade zinc-lead ore and old tailing deposits ceased operations and the large producers curtailed operations. On January 1 the price of lead was 21.5 cents a pound and zinc 17.5 cents a pound; at the close of the year lead was 12 cents a pound and zinc 9.75 cents a pound. In 1949 the output of gold decreased more than 27 percent from 1948, silver 14, copper 16, lead 10, and zinc 11. The value of the metal output of the region was $50,699,924 (90 percent of the State value), a decrease of $11,469,031 (18 percent) from 1948. Although the State lead output exceeded the zinc output, it was the reverse in the Coeur d'Alene region, where the zinc output exceeded that of lead by only 435,200 pounds (less than one-half percent). The region remained the largest silver-producing area in the United States and ranked second in lead and zinc; it produced 91 percent of Idaho's silver, 81 percent of the copper, 94 percent of the lead, and 97 percent of the zinc. The chief producers of zinc in the region in 1949, according to rank, were the Star, Page, Morning, Sidney, Bunker Hill & Sullivan, Frisco, Amazon-Carlisle, Spokane-Idaho, and Highland-Surprise properties. The chief producers of lead, according to rank, were the Bunker Hill & Sullivan, Page, Star, Morning, Sherman and Sidney properties. The chief producers of silver, according to rank, were the Sunshine, Bunker Hill & Sullivan, Polaris, Page, Silver Dollar, and Sherman properties.

Of the total material (2,282,614 tons) produced in 1949 in the Coeur d'Alene region, 81 percent was zinc-lead ore and old tailings, 11 percent silver-lead ore, 6 percent silver ore, and 2 percent zinc ore and slag. Twenty-nine mills, with an aggregate capacity of 12,700 tons of ore a day, operated in the region in 1949.

Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, 1948–49, and total 1884–1949, in terms of recoverable metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer, fine ounces)	Silver (lode and placer, fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer							
1948	65	7	3,165,780	3,362	10,598,338	2,775,000	165,174,000	167,601,000	$62,168,955
1949	61	1	2,282,614	2,438	9,146,146	2,341,000	148,304,000	148,739,200	50,699,924
Total 1884–1949			(1)	401,674	461,256,814	[2] 69,235	[2] 5,761,866	[2] 1,434,288	1,285,021,193

[1] Figure not available.
[2] Short tons.

Beaver District.—In 1949 eight mines in the Beaver district produced 141,550 tons of ore containing 183 ounces of gold, 112,487 ounces of silver, 118,976 pounds of copper, 5,115,108 pounds of lead, and 13,113,770 pounds of zinc. The principal output was 94,588 tons of zinc-lead ore produced from the Amazon-Carlisle-Interstate-Silver Tip groups by Day Mines, Inc.; the ore was treated in the Carlisle 500-ton flotation mill near Wallace. Lessees worked the Parrott mine, owned by Day Mines, Inc., and hauled 6,219 tons of zinc-lead ore to the Hercules and Golconda custom flotation mills, also near Wallace. According to the annual stockholders' report of Day Mines, Inc., for 1949, ore breaking at the Amazon-Carlisle group ceased August 31 owing to the low prices of lead and zinc. The Sunset Lease (a partnership in which Day Mines, Inc., has a 70-percent interest) operated the Sunset mine throughout the year and hauled 21,584 tons of zinc-lead ore to custom mills near Wallace. However, ore breaking in the mine ceased in June owing to a drop in prices of lead and zinc. Zanetti Bros. operated the waste dump at the Sunset property and the Rex flotation mill near Wallace; 1,430 tons of zinc-lead ore from the dump were hauled to the mill for treatment. Zanetti Bros. also operated the waste dump at the Interstate property and hauled 16,672 tons of low-grade zinc-lead ore to the Rex mill. The remainder of the district output was 1,057 tons of lead ore produced from the Blue Grouse, Idora, and Sitting Bull properties.

Evolution District.—The output of the Evolution district in 1949 comprised 250,814 tons of zinc-lead old tailings, 152,816 tons of silver-lead ore, 10,050 tons of silver ore, 1,562 tons of silver-antimony ore, and 90 tons of mill cleanings (lead). Most (194,495 tons) of the old tailings came from the Big Creek deposit and Osburn dump; all the silver-lead ore and 3,211 tons of silver ore from the Chester vein, Silver Syndicate fault zone, Yankee Girl vein, and Sunshine vein, operated by the Sunshine Mining Co.; 6,839 tons of silver ore from the Silver Summit mine; and all the silver-antimony ore from the Mineral Point mine. The Chester vein and Silver Syndicate fault zone include property owned by the Sunshine Mining Co., Polaris Mining Co., Silver Dollar Mining Co., and Silver Syndicate, Inc., and the Yankee Girl vein includes property owned by the Sunshine Mining Co., Sunshine Consolidated Mining Co., and the Metropolitan Mines Corp.; but all exploration, development, mining, and milling of ore are done by the Sunshine Mining Co. The Sunshine Mining Co. reported that the total output of ore in 1949 was 156,027 tons (89,089 tons for Sunshine account and 66,938 tons for account of Polaris, Silver Dollar, Silver Syndicate, Sunshine Consolidated, and Metropolitan) compared with 148,339 tons in 1948. The 1,350-ton Sunshine flotation mill operated 237 days on ore averaging 30.89 ounces of silver to the ton, 2.47 percent lead, and a little copper and zinc. The tailings averaged 0.57 ounce of silver to the ton and 0.06 percent lead; lead recovery was 98.3 percent and silver 97.9 percent. Lead-silver concentrates (15,083 tons) contained 4,742,708 ounces of silver, 1,246,132 pounds of copper, 7,544,502 pounds of lead, and 525,000 pounds of zinc, of which the net for Sunshine account was 2,682,519 ounces of silver, 753,638 pounds of copper, and 3,165,822 pounds of lead. The average operating costs for the year per ton were $12.10 for mining, $0.90 for milling, $0.23 for

depreciation, and $3.78 for general expense—a total of $17.01 compared with $16.55 in 1948. According to the annual report of the Sunshine Mining Co., mining operations were suspended from September 8 to November 21, owing to a labor strike in the district which began with closing of the Bunker Hill smelter August 20. As a result of this interruption, production of the mine for the year was about 75 percent of what it might have been. Development in 1949 comprised 2,876 feet of drifting, 2,673 feet of crosscutting, and 2,562 feet of raising. Developed ore reserves are estimated at 1,090,000 tons above the 3,700-foot level. This estimate includes the total estimated reserves in areas in which other companies share the production.

The Federal Mining & Smelting Co. worked the Big Creek tailing deposit all year and hauled 99,600 tons of zinc-lead old tailings to the Polaris mill at Osburn. The concentrates (2,629 tons) contained 32 ounces of gold, 63,154 ounces of silver, 48,500 pounds of copper, 1,316,804 pounds of lead, and 1,692,330 pounds of zinc. Zanetti Bros. worked the Osburn tailing deposit all year and hauled 94,895 tons of zinc-lead old tailings to the Polaris mill. The tailings contained an average of 0.907 ounce of silver to the ton, 1.233 percent lead, and 1.343 percent zinc. Zanetti Bros. also worked the DeBlock tailing deposit at the mouth of Lake Gulch and hauled about 24,000 tons of zinc-lead old tailings to their Galena mill. About 30,600 tons of similar tailings from the Burlett-Heller property were treated in the Coeur d'Alene Mines Corp. mill near Osburn by the Shoshone Leasing Co.

Development and exploration at the Silver Summit mine of the Silver Summit Mining Co. were done in 1949 by the Polaris Mining Co. on a cooperative basis between the two companies. During the year 6,839 tons of ore—containing 201,480 ounces of silver and 95,706 pounds of copper—were produced from the mine and treated in the Polaris mill. According to the annual report of the Polaris Mining Co., development at the Silver Summit mine in 1949 exposed 467 feet of very good grade ore on the 3,200-foot level.

According to the annual report of the Coeur d'Alene Mines Corp. for 1949, operations at the Mineral Point mine were confined mainly to development, exploration, and maintenance. The only ore mined and treated was 1,562 tons containing 8,900 ounces of silver, 16,312 pounds of copper, and a little antimony. The rest of the district output was 1,731 tons of zinc-lead old tailings and 90 tons of mill cleanings (lead) salvaged from the mill site of the Hecla Mining Co. at Osburn.

Hunter District (Mullan).—In 1949 six properties in the Hunter district produced 363,579 tons of ore and 872 tons of old tailings containing 478 ounces of gold, 718,725 ounces of silver, 341,683 pounds of copper, 29,449,396 pounds of lead, and 53,219,612 pounds of zinc. The Star mine of the Sullivan Mining Co. continued to be the principal producer, and in 1949 remained the largest producer of zinc in Idaho and ranked third in lead. The company operated the mine and its 1,000-ton flotation mill all year; the mill treated 230,241 tons of zinc-lead ore, yielding 7,339 tons of lead concentrate and 34,417 tons of zinc concentrate, which together contained 182 ounces of gold,

189,132 ounces of silver, 113,374 pounds of copper, 12,552,293 pounds of lead, and 35,454,872 pounds of zinc.

The Morning mine and 1,250-ton flotation mill of the Federal Mining & Smelting Co. at Mullan were operated continuously and at a higher rate than in 1948, because of an adequate supply of mine labor. The company reported that 87,757 tons of mine ore were treated in 1949 compared with 71,261 tons in 1948; the ore contained an average of 2.12 ounces of silver to the ton, 6.91 percent lead, and 8.22 percent zinc. According to the annual stockholders' report of the company for 1949, there is little chance of developing further appreciable tonnages of ore in the Morning mine above the 4,850-foot level. Present ore reserves at the current rate of production are sufficient for only 3 years' operation. The present shaft must be continued down to the 5,050-foot level if ore below the 4,850-foot level is to be mined. Ore reserves at the end of the year—above the 4,850-foot level—were estimated at 269,000 tons.

The Gold Hunter Mines, Inc., worked its mine at Mullan until April 10 when it was closed, but the company 500-ton flotation mill continued operating on waste-dump ore and old tailings until October 30. The company reported that 9,710 tons of mine ore and 13,350 tons of dump ore and old tailings were treated in 1949, which together yielded 717 tons of concentrates containing 40,038 ounces of silver, 2,200 pounds of copper, 693,530 pounds of lead, and 153,690 pounds of zinc.

The Lucky Friday Silver-Lead Mines Co. worked its mine continuously and hauled 15,083 tons of ore—containing an average of 14.58 ounces of silver to the ton, 4.11 percent lead, and 1.29 percent zinc—to the Golconda custom flotation mill. The remainder of the district output was largely 7,342 tons of zinc-lead-silver ore produced from the Golconda mine.

Lelande District (Burke, Mace, Frisco).—The output of the Lelande district in 1949 was 180,443 tons of ore and old tailings containing 314 ounces of gold, 474,021 ounces of silver, 129,828 pounds of copper, 16,476,079 pounds of lead, and 14,320,406 pounds of zinc. The most important producer was the Sherman mine of Day Mines, Inc. The company reported that 55,647 tons of ore containing an average of 6.10 ounces of silver to the ton, 9.12 percent lead, and 1.98 percent zinc were treated in the Sherman 300-ton flotation mill near Burke. The mine was closed from October 4 to November 22 because of a labor strike in the district.

The lower levels of the Frisco mine were worked by the Federal Mining & Smelting Co. and the upper levels by the Hull Lease. From the lower levels, 48,572 tons of zinc-lead ore (containing an average of 1.39 ounces of silver to the ton, 4.43 percent lead, and 6.69 percent zinc) were hauled to the Morning mill at Mullan for treatment. From the upper levels, the Hull Lease treated in its own 90-ton flotation mill 26,575 tons of ore, containing an average of 0.44 ounce of silver to the ton, 0.88 percent lead, and 7.86 percent zinc. The mine was closed from September 7 to November 22 because of a labor strike. The Federal Mining & Smelting Co. estimated the ore reserves at the Frisco mine at the end of 1949 to be 196,080 tons.

In April and May, 24,118 tons of old tailings (containing 0.67 ounce of silver to the ton, 0.96 percent lead, and a little copper and zinc)

from the West Star property were treated in the Hecla flotation mill at Gem. About 14,450 tons of zinc-lead old tailings deposited along Canyon Creek near Wallace were hauled to the Hercules and Golconda custom mills for treatment. The rest of the district output was mainly 10,296 tons of zinc-lead ore produced from the Hercules and Black Bear mines near Burke.

Placer Center District.—The output of the Placer Center district in 1949 was 149,673 tons of ore and 18,332 tons of old tailings, which contained 180 ounces of gold, 303,413 ounces of silver, 85,200 pounds of copper, 11,207,394 pounds of lead, and 7,537,162 pounds of zinc. The principal producer was the Tamarack mine of Day Mines, Inc. The company reported that 60,765 tons of ore containing an average of 1.08 ounces of silver to the ton, 3.29 percent lead, and 4.53 percent zinc were treated in the Tamarack flotation mill at Dorn. The mine was closed from October 4 to November 22 because of a labor strike. Day Mines, Inc., also operated its Dayrock mine and 350-ton flotation mill at Bunn. The mill treated 50,110 tons of ore containing an average of 3.17 ounces of silver to the ton, 4.92 percent lead, and 0.42 percent zinc. During the first quarter of the year 34,350 tons of waste-dump ore (containing an average of 1.45 ounces of silver to the ton, 1.96 percent lead, and 0.47 percent zinc) from the Rex property were hauled to the Hecla mill at Gem for treatment. The remainder of the district output was 18,332 tons of zinc-lead old tailings from the Nine Mile, Tomsche, and Woodland properties and 4,448 tons of zinc-lead ore from the Success and Tamarack No. 5 mines operated by lessees.

Summit District (Murray).—About 400 tons of zinc-lead ore were produced in 1949 from the Anchor mine near Murray and 100 tons of gold ore from the Golden Chest mine. Placer gold (13 ounces) was recovered by sluicing at the Gardner claim on Pritchard Creek.

Yreka District (Kellogg).—The value of the metal output of the Yreka district was $23,904,333 in 1949, a loss of $5,392,786 (18 percent) from that in 1948. In spite of this loss the value was more than double that of any other district in Idaho; the district remained by far the chief lead- and zinc-producing area in Idaho and ranked second in silver. In 1949 material produced from the district comprised 680,945 tons of zinc-lead-silver ore, 245,633 tons of old zinc-lead tailings, 43,577 tons of old zinc-lead-iron tailings, 22,389 tons of old zinc slag, 14,897 tons of lead ore, and 4,861 tons of siliceous silver tailings—a total of 1,012,302 tons compared with 1,171,090 tons in 1948. Of the total ore, old tailings, and old slag, 381,940 tons (containing 1,234 ounces of gold, 976,949 ounces of silver, 404,000 pounds of copper, 36,994,835 pounds of lead, and 56,676,517 pounds of zinc) were zinc-lead-silver ore from eight mines in the Pine Creek area of the district; the Page and Sidney mines were the chief producers. However, the Bunker Hill & Sullivan mine at Kellogg, with an output of 299,005 tons of zinc-lead-silver ore and 14,850 tons of lead ore in 1949, continued to be the most important producer of ore in the district, the largest producer of lead in the State, ranked second in silver, and fifth in zinc. The company main 2,000-ton flotation mill, equipped with sink-and-float unit, treated 299,005 tons of zinc-lead-silver ore from the Bunker Hill & Sullivan mine and 245,633 tons of old zinc-lead tailings from the Bunker Hill & Sullivan mill tailing dump. The ore contained an average of 5.44

ounces of silver to the ton, 7.34 percent lead, and 2.06 percent zinc, and the old tailings 0.76 ounce of silver to the ton, 1.39 percent lead, and 0.66 percent zinc. John George continued leasing operations in the upper levels of the Bunker Hill & Sullivan mine and treated about 14,850 tons of lead ore in his mill. The Bunker Hill & Sullivan Mining & Concentrating Co. also treated 43,577 tons of old jig tailings (containing 1.02 ounces of silver to the ton, 2.29 percent lead, 1.01 percent zinc, and 13.30 percent iron) in its 300-ton gravity-flotation plant and shipped 22,389 tons of old Bunker Hill smelter slag (containing 0.375 ounce of silver to the ton, 1.84 percent lead, and 12.20 percent zinc) to its lead smelter at Bradley. The resulting hot slag was sent to the company slag-fuming plant, also at Bradley, to recover the zinc. According to the company annual report to stockholders, there were produced and recovered from Bunker Hill & Sullivan mine ore (including lessee ore) 1,584,383 ounces of silver, 43,541,540 pounds of lead, and 10,564,300 pounds of zinc. A labor strike at the Bunker Hill smelter, which began August 20, caused closing of the Bunker Hill & Sullivan mine from August 31 to November 14, after 50 years of continuous production. An important discovery was made during the year of a heretofore unknown ore body in relatively unmined territory on the Bunker Hill No. 17 level. The extent of this large body of high-grade lead-silver ore is not yet proved. Ore reserves fully developed and ready for mining January 1, 1950, totaled 2,963,084 tons of zinc-lead-silver ore, a decrease of 63,800 tons from January 1, 1949. The zinc slag-fuming plant of the Bunker Hill & Sullivan Mining & Concentrating Co. at Bradley ran continuously until August 20, when it closed because of a strike at the Bunker Hill lead smelter. In 1949 the plant received 81,781 tons of current hot slag from the lead furnaces of the Bunker Hill smelter at Bradley; the resulting zinc-lead fume (3,068 tons) was sent to the Bunker Hill lead smelter, and the zinc fume (12,589 tons) was shipped to smelters in Kansas and Texas. All of the lead and zinc produced at the plant in 1949 was credited to the mines and an old slag dump furnishing the slag-making material.

Output of zinc-lead-silver ore from the Page mine of the Federal Mining & Smelting Co. declined from 158,179 tons in 1948 to 154,230 tons in 1949. The ore, treated in the Page 500-ton flotation mill, contained an average of 4.03 ounces of silver to the ton, 6.87 percent lead, and 7.13 percent zinc. The mine ranked second in lead and zinc production in Idaho in 1949 and fourth in silver. According to the company annual report to stockholders, operations at the Page mine were continuous throughout the year. A surplus of mine labor developed toward the end of the year, and all crews were full. Development of the 2,770-foot level of the Tony vein has not been completed, but results to date are equally as good as those on the 2,400-foot level. Ore reserves at the end of the year were estimated at 911,026 tons, an increase of 58,344 tons over the estimated tonnage at the end of 1948.

The Sidney Mining Co. operated its mine on Denver Creek all year, but the company 250-ton flotation mill was idle from August 20 to November 20. Output of zinc-lead-silver ore from the mine declined from 89,724 tons in 1948 to 63,499 tons in 1949; the ore contained an average of 2.77 ounces of silver to the ton, 5.72 percent lead, and 9.71 percent zinc. The Highland-Surprise Consolidated Mining Co.

worked its mine on Stewart Creek from January 1 to September 9 and from December 1 to December 31. Zinc-lead ore treated in the company 300-ton flotation mill dropped from 72,925 tons in 1948 to 52,255 tons in 1949. Mining and milling of zinc-lead ore from the Spokane-Idaho mine on Pine Creek were continuous throughout the year. The company 175-ton flotation mill treated 50,623 tons of zinc-lead ore in 1949 compared with 54,917 tons in 1948. The Sunset Minerals, Inc., operated the Liberal King mine on Pine Creek all year and treated 24,596 tons of zinc-lead ore in its 100-ton flotation mill, compared with 24,586 tons in 1948. Output of zinc-lead ore from the Little Pittsburg mine on Denver Creek declined from 22,139 tons in 1948 to 15,726 tons in 1949; the ore was treated in the Denver Development Co. 150-ton flotation mill. The rest of the district output was mainly zinc-lead ore (21,000 tons) produced from the Douglas and Nabob mines on Pine Creek.

VALLEY COUNTY

Yellow Pine District.—The Bradley Mining Co. operated its Yellow Pine mine and 2,000-ton flotation mill at Stibnite all year. The company reported that in 1949 the mill treated 610,988 tons of ore containing 0.112 ounce of gold and 0.209 ounce of silver to the ton, and 0.344 percent antimony. The antimony concentrates (4,558 tons) and gold concentrates (20,404 tons) contained 53,576 ounces of gold, 92,439 ounces of silver, and 3,163,735 pounds of antimony. Gold production in 1949 was nearly double that of 1948, but production of silver and antimony was much less. In 1949 the mine produced 69 percent of Idaho's gold output. Construction of a smelter at Stibnite, for reduction of the antimony and gold concentrates produced at the company mill, was completed in August.

WASHINGTON COUNTY

All the output in Washington County in 1949 was 3,160 ounces of silver and 1 ounce of gold recovered from treating 4 tons of old mill cleanings at Mineral in the Washington district.

Missouri, Oklahoma, Kansas, and Arkansas
Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. Martin

GENERAL SUMMARY

ECONOMIC conditions affecting lead and zinc mining in Missouri, Oklahoma, Kansas, and Arkansas were erratic in 1949. From January to March production trended upward, as the market prices of lead and zinc were high enough in relation to the cost of labor and materials—a situation stimulating the mining of lower-grade ores, of which there are large reserves. In March the monthly production was the highest since April 1946 for lead and since June 1947 for zinc. The production trend was reversed by a downward movement in metal prices that began in March and culminated in a 44-percent decrease in the lead price by May 26 and a 49-percent decline in zinc by June 15. In the Tri-State zinc-lead district of southwestern Missouri, Oklahoma, and Kansas—which contributed 99 percent of the four-State total output of zinc—the price of zinc concentrate declined from \$110 to \$50 a ton and lead concentrate from \$290.92 to \$148.63. The decline disrupted virtually all Tri-State operations, causing indefinite closing, temporary shutdown, or curtailment. Concentrate prices from July to December, although averaging higher than the June lows, were inadequate to enable the Tri-State mines to operate without a material reduction in costs. It was therefore necessary for mines that continued producing to reduce wages and to resort to selective mining. The total district production of zinc in 1949 was 7 percent less than in 1948 and the lowest since 1896.

Production of lead for the year was higher than in 1948 despite the sharp drop in the metal price. The large lead mines in the Southeastern Missouri region, which in 1948 were shut down 2½ months by labor strikes, operated continuously in 1949. In the Tri-State district selective mining resulted in the largest lead production there since 1943. The increase in the four States' total output was 23 percent over 1948 and 2 percent over 1947, when the operating time of the Southeastern Missouri mines was normal.

Missouri has been a substantial producer of copper in recent years; the output in 1949 was the highest on record. Part of the copper was recovered from copper concentrates produced from lead-copper-(cobalt-nickel-iron) ore, and part was recovered as a byproduct in smelting lead concentrates. The Missouri output of silver is incidental to the production of lead and copper.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of silver, copper, lead, and zinc in Arkansas, Kansas, Missouri, and Oklahoma in 1945–48 and, by States, in 1949, in terms of recoverable metals

	Mines producing	Material sold or treated		Silver	
		Crude ore (short tons)	Old tailings (short tons)	Fine ounces	Value
1945	247	14,163.065	11,271,347	94,822	$67,429
1946	269	13,831,590	10,178,620	69,401	56,076
1947	254	11,837,403	6,041,783	93,600	84,708
1948	294	8,537,796	3,760,259	114,187	103,345
1949					
Arkansas	2	6			
Kansas	70	1,602,976	544,034		
Missouri	60	5,981,312	1,417,098	123,413	111,695
Oklahoma	100	2,543,835	1,050,586		
Total 1949	232	10,128,129	3,011,718	123,413	111,695

	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	3,399	$917,730	196,610	$33,816,920	140,172	$32,239,560	$67,041,639
1946	1,857	601,668	159,256	34,717,808	139,574	34,056,056	69,431,608
1947	1,760	739,200	153,838	44,305,344	109,651	26,535,542	71,664,794
1948	2,370	1,028,580	127,614	45,685,812	85,892	22,847,272	69,665,009
1949							
Arkansas			1	316	1	248	564
Kansas			9,772	3,087,952	29,433	7,299,384	10,387,336
Missouri	3,670	1,445,980	127,522	40,296,952	5,911	1,465,928	43,320,555
Oklahoma			19,858	6,275,128	44,033	10,920,184	17,195,312
Total 1949	3,670	1,445,980	157,153	49,660,348	79,378	19,685,744	70,903,767

Mine production of silver, copper, lead, and zinc in Arkansas, Kansas, Missouri, and Oklahoma in 1949, by months, in terms of recoverable metals

Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	7,899	201	12,310	7,002
February	8,174	243	13,070	8,313
March	11,270	293	14,834	9,801
April	9,196	255	12,685	9,434
May	10,065	289	12,784	7,001
June	11,199	328	13,047	6,407
July	10,131	280	10,868	5,928
August	12,057	413	14,065	5,209
September	11,087	380	13,568	5,863
October	10,627	308	13,189	5,713
November	10,933	341	13,427	5,951
December	10,775	339	13,306	6,756
Total: 1949	123,413	3,670	157,153	79,378
1948	114,187	2,370	127,614	85,892

Silver.—Smelters treating southeastern Missouri lead concentrates continued to recover silver as a byproduct. These concentrates usually contain 1 to 2 ounces of silver a ton, but much of the silver goes into undesilverized lead and is not recorded as recoverable production. The copper concentrates made from lead-copper ore also contain some silver. The total silver recovered in 1949 was 123,413 fine ounces, compared with 114,187 ounces in 1948.

Copper.—The Missouri output of copper increased from 2,370 tons in 1948 to 3,670 tons in 1949. The production of copper concentrates by the Madison mill at Fredericktown, Madison County, which treats lead-copper ore, showed a large gain over 1948. The quantity of copper contained in byproduct matte shipped from smelters treating lead concentrates also increased.

Lead.—The production of recoverable lead in the four States in 1949 totaled 157,153 tons, comprising 126,269 tons from the Southeastern Missouri region, 30,883 tons from the Tri-State district, and 1 ton from Arkansas. In 1948 the output totaled 127,614 tons and comprised 100,654 tons from the southeastern Missouri region, 26,901 tons from the Tri-State district, 37 tons from the central Missouri region, and 22 tons from Arkansas. The large lead mines in southeastern Missouri operated continuously in 1949, whereas in 1948 they were shut down 2½ months by a labor strike. The increase in lead production in the Tri-State district resulted largely from selective mining of ore bodies of higher than average lead content after the price of zinc declined below the level required for mining low-grade, predominantly zinc ore.

Zinc.—The 79,378 tons of recoverable zinc produced in the West Central States in 1949 comprised 78,628 tons from the Tri-State district, 749 tons from southeastern Missouri, and 1 ton from Arkansas. In 1948 the Tri-State output was 84,839 tons, southeastern Missouri 1,022 tons, and Arkansas 31 tons—a total of 85,892 tons. The decrease in 1949 is attributable to curtailed operations at many mines and temporary or indefinite shut-downs at others caused by the nearly 55-percent decline in the quoted price of zinc concentrates at Joplin from March to June, with fluctuations near the lower level the rest of the year.

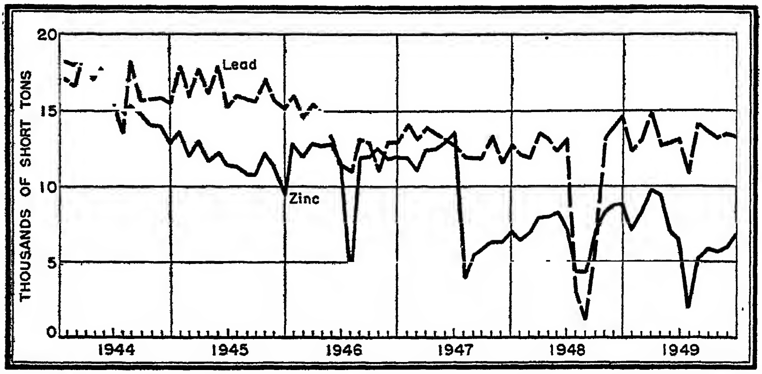

FIGURE 1.—Mine production of lead and zinc in Arkansas, Kansas, Missouri, and Oklahoma, 1944–49, by months, in terms of recoverable metals.

MINING AND METALLURGIC INDUSTRY

The tonnage of crude lead ore mined in southeastern Missouri in 1949 exceeded that of zinc-lead ore produced in the Tri-State field. The Tri-State tonnage was higher in all except three of the other years since individual mine production records were made available in 1907. The principal lead mines operated steadily throughout 1949, despite the sharp drop in the market price of lead, whereas few, if any, of the Tri-State zinc-lead mines could maintain production rates on the scale that prevailed before the break in metal prices in March necessitated abandonment of many headings in low-grade ore. Details of the effect on the Tri-State mining industry of the decline in prices of concentrate are given in a following section of this chapter.

Large-scale exploratory drilling by the mining companies was confined to the Southeastern Missouri region, but scattered drilling continued in the Tri-State district. The Bureau of Mines carried on drilling projects in the Tri-State district and made field examinations and metallurgical tests on ores from various districts in the four States.

Seven mills were operating in the Southeastern Missouri region and 20 in the Tri-State district in December 1949 compared with 8 and 36, respectively, in 1948. The 27 mills active in December 1949 had daily capacities ranging from 60 to 15,000 tons and averaged 2,278 tons. Gravity concentration and flotation were used in nearly all the mills. Flotation concentrates comprised 44 percent of the total lead concentrates and 66 percent of the zinc concentrates produced. The active smelters were the lead smelters at Galena, Kans., and Herculaneum, Mo.; the zinc smelters at Bartlesville, Blackwell, and Henryetta, Okla., and Fort Smith, Ark.; and the oxide plant at Coffeyville, Kans.

ORE CLASSIFICATION

The following table classifies the combined ore and old tailings produced in Arkansas, Kansas, Missouri, and Oklahoma in a manner comparable to the classes shown in the tables on ore classification in the chapters devoted to mining in the Western States. The basis for classification is given in the Gold and Silver chapter of this volume. Additional details of the tenor of ore and old tailings milled and the concentrates produced in Kansas, Missouri, and Oklahoma are given

in tables in the Tri-State District and Review by States sections that follow. Such tables for Arkansas are omitted because only small-scale intermittent mining of lead and zinc was done there from 1918 through 1949.

Ore and old tailings sold or treated in Arkansas, Kansas, Missouri, and Oklahoma in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore, etc. (short tons)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lead ore [1]	54	7,174,258	123,413	3,670	129,007	871
Zinc ore [2]	55	2,349,555			1,235	21,740
Zinc-lead ore	123	3,616,034			26,911	56,767
Total: 1949	232	13,139,847	123,413	3,670	157,153	79,378
1948	294	12,298,055	114,187	2,370	127,614	85,892

[1] Includes lead-copper ore from 1 mine; also, 1,409,098 tons of old tailings remilled, concentrates from which were mixed with those from crude ore.
[2] Includes 1,602,620 tons of old tailings yielding 4,217 tons of recoverable zinc and 29 tons of lead.

TRI-STATE DISTRICT

For the first 3 months of 1949 production of zinc and lead concentrates in the Tri-State district trended upward, and the output in March was the highest since June 1947. During the next 3 months production decreased heavily as a result of successive sharp declines in the prices of concentrates. About 50 of the mines shut down, and most of the other 76 that were active curtailed production. The decrease in the June output compared with March was 35 percent

Production of lead and zinc concentrates in the Tri-State district (Kansas, Oklahoma, and southwestern Missouri), 1945–49

Year	Ore, etc., milled (short tons)	Concentrates produced (short tons)		Concentrate recovery (percent)		Average assay of concentrates (percent)		Average value per ton of concentrates	
		Lead	Zinc	Lead	Zinc	Lead	Zinc	Lead	Zinc
FROM CRUDE ORE									
1945	7,441,345	31,643	217,790	0.43	2.93	75.61	59.96	$125.00	$110.48
1946	8,271,512	30,468	224,910	.37	2.72	77.40	59.88	164.81	116.15
1947	6,229,702	31,842	181,662	.51	2.92	77.41	59.68	190.72	107.42
1948	4,314,190	35,706	147,989	.83	3.43	76.64	59.09	231.85	87.10
1949	4,470,778	41,422	139,098	.93	3.11	76.00	59.44	188.76	77.53
FROM OLD TAILINGS REMILLED									
1945	11,271,347	201	41,211	0.002	0.37	51.24	58.67	69.12	104.97
1946	10,178,620	182	33,795	.002	.33	48.35	58.60	90.85	117.10
1947	5,740,459	164	22,406	.003	.39	46.42	58.31	107.09	101.69
1948	2,595,903	156	11,620	.006	.45	51.28	58.47	155.14	89.50
1949	1,602,620	49	8,090	.003	.50	59.18	57.98	119.22	81.71
DISTRICT TOTAL									
1945	18,712,692	31,844	259,001	0.17	1.38	75.45	59.75	124.65	109.66
1946	18,450,132	30,650	258,705	.17	1.49	77.23	59.71	164.37	116.27
1947	11,970,161	32,006	204,068	.27	1.70	77.25	59.53	190.39	106.79
1948	6,910,093	35,862	159,609	.52	2.31	76.53	59.04	231.51	87.27
1949	6,073,398	41,471	147,178	.63	2.42	75.98	59.36	188.68	77.76

for zinc concentrates and 34 percent for lead concentrates. The July production of zinc concentrates, reduced to an exceptionally low level by previous shut-downs and a work stoppage at the mines and mills of the Eagle-Picher Mining & Smelting Co., was only 3,529 tons compared with 18,256 tons in the peak month of March. From August through December the monthly production of zinc concentrates averaged 10,891 tons and lead concentrates 3,552 tons.

The district total production in 1949 was 147,178 tons of zinc concentrates valued at $11,445,018 and 41,471 tons of lead concentrates valued at $7,824,788—a total value of $19,269,806 compared with $22,231,715 in 1948. The production of zinc concentrates in 1948 was 159,609 tons valued at $13,929,151 and that of lead concentrates 35,862 tons valued at $8,302,564. The output in 1949, in terms of recoverable metals, was 78,628 tons of zinc and 30,883 tons of lead compared with 84,839 and 26,901 tons, respectively, in 1948.

Weekly quoted prices for 60-percent zinc concentrates and 80-percent lead concentrates at Joplin, 1949

Zinc concentrates				Lead concentrates			
Week ended	Price	Week ended	Price	Week ended	Price	Week ended	Price
Jan. 1–Mar. 19	$110.00	July 23	$53.00	Jan. 1–Mar. 5	$290.92	Aug. 6	$187.51
Mar. 26–Apr. 2 [1]	102.50	July 30–Sept. 3	57.00	Mar. 12	256.12	Aug. 13	191.11
Apr. 9	95.00	Sept. 10 [2]	60.00	Mar. 19–26	234.52	Aug. 20–27	192.91
Apr. 16	87.50	Sept. 17–Oct. 1	57.00	Apr. 2	205.51	Sept. 3–24	192.67
Apr. 23	82.50	Oct. 8–22	51.00	Apr. 9–30	191.11	Oct. 1	187.27
Apr. 30–May 7	79.00	Oct. 29	53.00	May 7–21	176.71	Oct. 8–15	172.87
May 14–21	75.00	Nov. 5	55.00	May 28–July 2	148.63	Oct. 22–Nov. 5	162.07
May 28	67.50	Nov. 12–19	57.00	July 9	163.03	Nov. 12	158.47
June 4	65.00	Nov. 26–Dec. 24	55.00	July 16–23	176.71	Nov. 19	154.87
June 11	55.00	Dec. 31	57.00	July 30	183.91	Nov. 26–Dec. 31	147.67
June 18–July 16	50.00						

[1] After the price began declining March 26, the Eagle-Picher Mining & Smelting Co. paid $2.50 a ton above the quoted market price for zinc concentrates made from ore treated in the company Central mill.
[2] Nominal price.

The five leading zinc-producing companies in the Tri-State district in 1949, in order of output, were: Eagle-Picher Mining & Smelting Co. (Oklahoma and Kansas), Nellie B. Mining Co. (Oklahoma), National Lead Co. St. Louis Smelting & Refining Division (Kansas), Federal Mining & Smelting Co. (Oklahoma and Missouri), and Sooner Milling Co. (Kansas and Oklahoma). In lead production the companies ranked as follows: Eagle-Picher, Nellie B., Federal, National Lead, and the W. M. & W. Mining Co. (Oklahoma).

As nearly all the Tri-State mines depend upon low-grade ore reserves, those that operated after the drastic decline in concentrate prices had to reduce costs materially. Considerable saving had already been accomplished by improving techniques of mining, ore haulage, and milling. An article describing the use of trackless equipment underground by one company was published.[1] Employees did their part by accepting wage reductions and maintaining work efficiency.

In December about 85 mines, 18 mine mills, 1 tailing mill, and 1 slime or clean-up mill were operating compared with 120, 29, 4, and 3, respectively, in December 1948. These mines do not include many

[1] Clarke, S. S., Diesel Power Underground: Min. Cong. Jour., vol. 35, No. 11, November 1949, pp. 22–28.

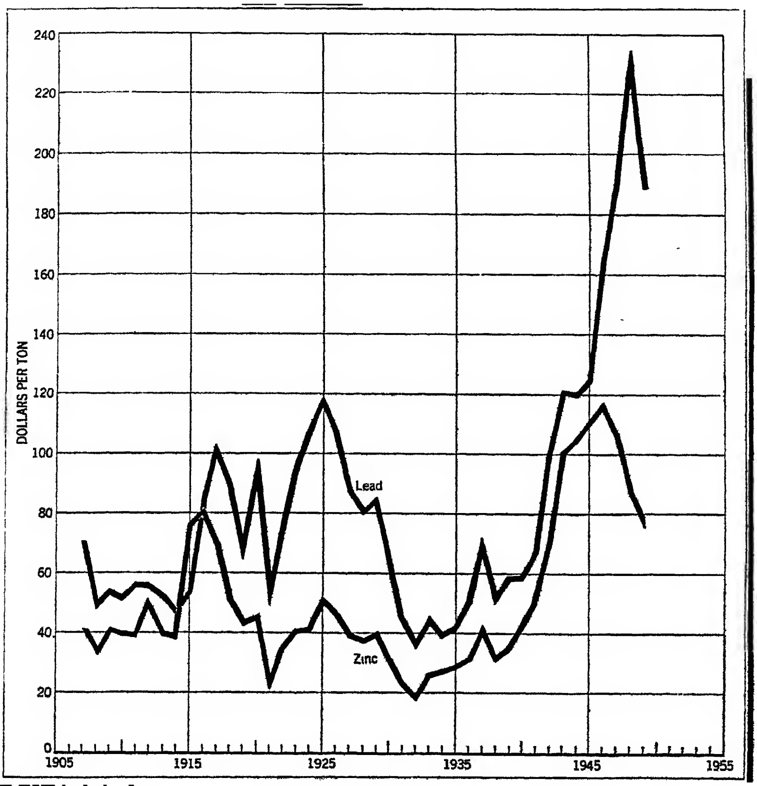

FIGURE 2.—Average prices received by sellers per ton of concentrates in the Tri-State district, 1907–49.

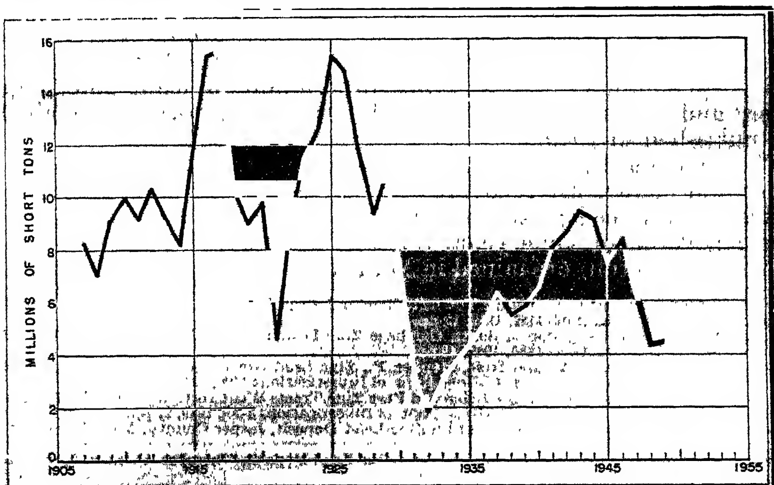

FIGURE 3.—Quantity of crude ore milled in the Tri-State district, 1907–49.

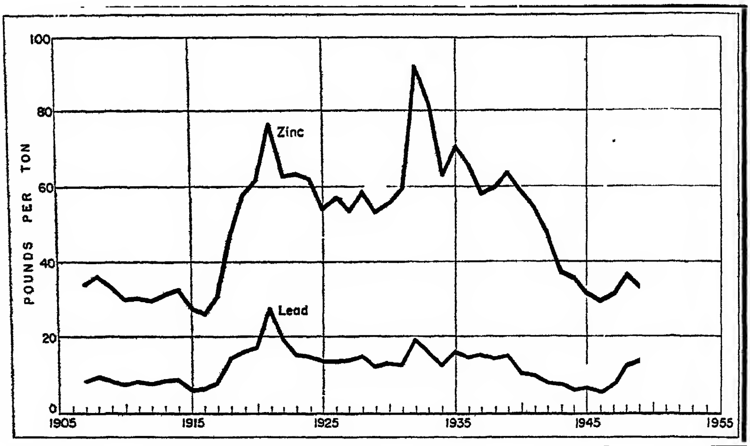

FIGURE 4.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1907–49.

small, intermittent producers; the total producing mines, gouges, and mill and dump clean-ups active all or part of 1949 was 216 compared with 270 in 1948. The depth of 122 operating shafts ranged from 30 to 450 feet and averaged 230 feet; open pits, worked at depths ranging from a few feet to 90 feet, yielded 120,000 tons of ore—less than 3 percent of the district total output of crude ore.

A few rigs were kept on exploratory drilling by the mining companies. The Bureau of Mines had drilling projects in the Canyon Diggings, Mo., and Melrose, Kans., areas. Data on certain drilling projects were published during the year.[2]

REVIEW BY STATES

MISSOURI

Missouri has been the chief lead-producing State for 42 consecutive years and until 1918 had ranked first in zinc production for many years. A summary of the State production of lead, zinc, copper, silver, and other minerals from the earliest records through 1947 was published in 1949.[3]

The principal lead mines are in the Southeastern Missouri district. Silver and copper are recovered as byproducts in smelting lead concentrates produced in this region, and copper and some silver have been recovered in some years (including 1944–49) from lead-copper-(cobalt-nickel-iron) ore mined in Madison County. Silver recoverable

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[2] Knox, Clinton C., Investigation of the Townsite Zinc and Lead Mine, Ottawa County, Okla.: Bureau of Mines Rept. of Investigations 4487, 1949, 13 pp.
Brichta, Louis C., Investigation of South Carthage Zinc-Lead Deposit, Jasper County, Mo.: Bureau of Mines Rept. of Investigations 4480, 1949, 49 pp.
Ruhl, Otto, Allen, Simeon A., and Holt, Stephen P., Zinc-Lead Ore Reserves of the Tri-State District, Missouri-Kansas-Oklahoma: Bureau of Mines Rept. of Investigations 4490, 1949, 59 pp.
Brichta, Louis C., Investigation of the Kline and Frey Zinc Tracts Wentworth Mining District, Lawrence and Newton Counties, Mo.: Bureau of Mines Rept. of Investigations 4489, 1949, 27 pp.
Brichta, Louis C., Investigation of Lone Elm Zinc-Lead Deposit, Jasper County, Mo.: Bureau of Mines Rept. of Investigations 4533, 1949, 29 pp.
Brichta, Louis C., Investigation of North Empire Zinc-Lead Deposit, Cherokee County, Kans.: Bureau of Mines Rept. of Investigations 4673, 1950, 48 pp.

[3] Bishop, O. M., The Mineral Industry of Missouri in 1946 and 1947, with Total Production Summarized: Missouri Div. of Geol. Surv. and Water Resources, Missouri Inf. Circ. 4, Rolla, 1949, 93 pp.

in 1949 totaled 123,413 fine ounces and copper 3,670 short tons compared with 114,187 ounces and 2,370 tons, respectively, in 1948. In the sale of the lead concentrates, no value is attached to the silver and copper, as the quantity recovered per ton of concentrates is very small. The zinc output comes largely from zinc-lead mines in southwestern Missouri. The Central district of Missouri had a small output of lead in 1945–48 and of zinc in 1945; the figures are included with those of southeastern Missouri in the table that follows.

Southeastern Missouri.—The principal lead mines in southeastern Missouri operated continuously in 1949; and production of lead increased 25 percent over 1948, when output was lower than usual because of work stoppages. The quantity of recoverable lead produced was 126,269 tons in 1949 and 100,654 tons in 1948. Zinc totaling 749 tons in 1949 and 1,022 tons in 1948 was recovered as a byproduct of lead mining and smelting.

In St. Francois County the St. Joseph Lead Co., largest producer of lead in the United States, operated its several large groups of mines and the Bonne Terre, Desloge, Federal, and Leadwood mills. The mills have a combined daily capacity of 26,800 tons. Treatment is by table concentration followed by flotation. The principal mine groups have underground, electrified, rail-haulage systems, which

Mine production of lead and zinc in Southeastern and Central Missouri districts, 1945–49

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)[1]		Metal content[2]			
					Lead		Zinc	
	Short tons	Value[3]	Short tons	Value	Short tons	Value	Short tons	Value
1945	245,805	$21,870,243	1,335	$45,706	173,053	$29,765,116	[4] 595	$136,850
1946	189,401	21,677,221	1,731	61,147	135,891	29,624,238	451	110,044
1947	183,084	31,762,029	560	15,996	129,581	37,319,328	[5] 295	71,390
1948	145,364	30,396,488	567	55,231	100,691	36,047,378	[5] 1,022	271,852
1949	179,725	32,665,768	1,074	79,347	126,269	39,901,004	[6] 749	185,752

[1] Includes zinc-lead carbonate concentrates.
[2] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.
[3] Values given are to a certain extent arbitrary, as part of the lead concentrates are smelted by the producer.
[4] Includes 240 tons recovered from byproduct matte from lead smelting.
[5] Includes zinc recovered from lead-smelter slag.
[6] Includes zinc recovered from lead-smelter byproducts.

Tenor of lead ore and concentrates in Southeastern Missouri disseminated-lead district, 1945–49

	1945	1946	1947	1948	1949
Total lead ore[1] ...short tons	5,675,767	5,491,239	5,856,334	5,384,861	7,066,443
Galena concentrates in ore ...percent	3.68	3.44	3.12	2.70	2.54
Average lead content of galena concentrates ...do	71.66	73.09	72.22	70.60	71.60
Average value per ton of galena concentrates	$88.95	$114.39	$173.49	$209.11	$181.75

[1] Includes lead-copper ore. Includes old tailings remilled: 1945-46—none; 1947—301,324 tons; 1948-1,164,356 tons; 1949—1,409,098 tons.

move the ore from the working faces to central ore-hoisting shafts. The four ore-hoisting shafts at the mills are 326, 276, 497, and 541 feet deep; the Doe Run shafts, from which ore is trucked to the Federal mill, are 160 and 179 feet deep. Other shafts are used for men, supplies, and waste rock. Development on the four groups in 1949 totaled 612 feet of shaft, 84,353 feet of drifting, 2,492,614 feet of diamond drilling, and 76,293 feet of churn drilling. The company also did exploratory drilling in adjacent counties. The following information was extracted from the company's eighty-sixth annual report to stockholders.

Further progress has been made during 1949 in modernizing underground facilities, and the effects of this program have already resulted in increased operating efficiency. Development work, during the year, was maintained in balance to the rate of mining. A new operating shaft, No. 22, which will open up the Hayden Creek orebody for exploitation, is virtually completed, and some production from this orebody is expected in 1950. It is planned to treat ore from this shaft, at the Leadwood Mill. The Desloge Mill continued throughout the entire year, to treat tailings; a total of 1,409,098 tons of tailings were milled at this plant and at the Company's Leadwood and Bonne Terre Mills. * * *

The lead bonus of 25 cents per shift worked for each one cent increase in the price of lead above 12 cents per pound in New York, which is applicable to all employees of this Division, continued in effect during the year. As lead prices declined, the bonus was from time to time reduced, and finally in December was frozen at a figure of 37½ cents per shift worked. No change was made in the basic wage rates. * * *

Approximately one-third of the Company's lead production in 1949 was smelted at Herculaneum and the balance of the production will continue, until 1953, to be smelted at East Alton, Illinois, when the present toll contract terminates with the American Smelting and Refining Company. The Herculaneum smelter was idle during the months of July and August, while replacements of worn-out flues and certain equipment were effected. The modernization program at this plant, which will continue through 1950, has already resulted in improvement in recoveries and some lowering of operating costs.

In Madison County the St. Joseph Lead Co. operated the Mine La Motte mine and 2,000-ton mill. Four shafts, 75, 116, 136, and 307 feet deep, were operated. Mine development during the year included 4,661 feet of drifts, 72,956 feet of diamond drilling, and 15,370 feet of churn drilling.

The National Lead Co. St. Louis Smelting & Refining Division operated its Madison lead-copper mine and 1,200-ton all-flotation mill at Fredericktown; the output of lead and copper concentrates showed a large increase over 1948. Four shafts, averaging 400 feet in depth, were used. The mine contains ore bodies that yield considerable iron, cobalt, and nickel with lead and copper, but operations in 1949 were confined chiefly to the mining of lead-copper ore. Development during the year included 67 feet of drifts, 1,194 feet of diamond drilling, and 58,928 feet of churn drilling.

The Catherine-Fleming mine was operated by the Park City Consolidated Mines Co. from January to March and by the Fredericktown Lead Co. the rest of the year. The Ruth mine of the Park City Consolidated Mines Co. was idle throughout 1949. The mill operated from January through March on ore from the Catherine-Fleming mine and was later sold for dismantling. In Jefferson County the

Fredericktown Lead Co. operated the leased Valle mine property during January and February and one week in May. Galena shipped from barite diggings in Washington and Jefferson Counties totaled 100 tons.

Southwestern Missouri.—The Tri-State district, which includes southwestern Missouri, is described in an earlier section of this chapter.

Production of zinc concentrates in southwestern Missouri in 1949 was the lowest since 1932; the decrease from 1948 was 8 percent. The Federal Mining & Smelting Co. Duenweg mine, operated about 10 months, was the largest producer of zinc in Missouri in 1949. The Dale Mining Co. Dungy mine at Stark City was the only substantial producer that operated continuously throughout the year; the company also operated the Ryder mine at Pioneer 3 months. Other properties that operated part of the year, mostly before the sharp declines in concentrate prices, included the Navy Bean mine and mill of the Consolidated Mines Co. near Wentworth, the Glen Richey Shinn mine at Stark City, the Federal Granby-American at Granby, the High Five at Waco, and the I. N. Clark Olsen mine at Spurgeon. At Aurora the Good Enuf Mining & Milling Co. built a 250-ton mill on the Good Enuf property and operated the mine and mill from September 29 through December. The St. Louis Mining & Milling Co. custom mill at Thoms Station operated intermittently; the largest shipper to the mill was the Lone Elm surface diggings, operated by W. O. York in January, February, and March. The Kansas Explorations Jasper mill operated about 4 months, treating custom ore from Galena, Kans. The Wildwood Mining Co. remodeled its Northside mill and treated considerable ore from "Mattes shaft" of the Wildwood property. The McNabb Coal Co. worked several months on stripping at the Quick 7 mine near Neck City and had test lots of ore treated in the Snapp mill. Ore from the Oronogo Circle dump was shipped to the Eagle-Picher Central mill at Cardin, Okla. The Bureau of Mines did exploratory drilling in the Canyon Diggings area.

Mine production of lead and zinc in southwestern Missouri, 1945–49

Year	Lead concentrates				Zinc concentrates				Metal content [1]			
	Galena		Carbonate		Sphalerite		Silicate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	4,679	$635,031	------	------	40,156	$4,605,647	606	$44,600	3,522	$605,784	21,580	$4,963,400
1946	4,220	734,676	84	$12,067	40,937	4,985,668	332	20,243	3,221	702,178	21,783	5,315,052
1947	3,412	655,030	168	23,866	31,480	3,402,384	763	49,235	2,665	767,520	16,779	4,060,518
1948	2,004	474,233	130	21,465	10,475	913,538	60	3,212	1,597	571,726	5,441	1,447,306
1949	1,574	340,038	14	1,618	9,667	774,272	20	777	1,253	395,948	5,162	1,280,176

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in southwestern Missouri, 1948–49

	1948		1949	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled ... short tons	297,598	14,395	323,967	8,000
Total concentrates produced:				
Lead ... do	2,109	25	1,587	1
Zinc ... do	10,393	142	9,591	96
Ratio of concentrates to ore, etc.:				
Lead ... percent	.71	.17	.49	.01
Zinc ... do	3.49	.99	2.96	1.20
Metal content of ores, etc.: [1]				
Lead ... do	.54	.10	.39	.01
Zinc ... do	2.01	.51	1.75	.61
Average lead content of galena concentrates ... do	77.72	56.00	80.74	66.00
Average lead content of lead carbonate ... do	56.92	----------	57.14	----------
Average zinc content of sphalerite concentrates ... do	57.54	51.41	59.31	51.04
Average zinc content of silicates and carbonates ... do	38.33	----------	40.00	----------
Average value per ton:				
Galena concentrates	$237.29	$185.52	$216.08	$150.00
Lead carbonate concentrates	$165.12	----------	$115.57	----------
Sphalerite concentrates	$87.39	$74.49	$80.38	$51.86
Zinc silicates and carbonates	$53.53	----------	$38.85	----------

[1] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.

OKLAHOMA

The Oklahoma output of recoverable zinc increased slightly (less than 1 percent) and lead increased 17 percent in 1949 from 1948. All the output in both years came from the area in Ottawa County in the northeastern corner of the State that is part of the Tri-State district. Factors affecting production in the district as a whole are discussed in an earlier section of this chapter. Oklahoma mines contributed 56 percent of the Tri-State district total output of zinc and 64 percent of the lead in 1949.

Mine production of lead and zinc in Oklahoma, 1945–49, and total, 1891–1949

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	17,198	$2,097,952	128,934	$14,021,165	12,664	$2,178,208	69,300	$15,939,000
1946	17,847	2,903,065	129,473	15,170,928	13,697	2,985,946	69,552	16,970,688
1947	18,857	3,600,407	95,126	10,699,593	14,289	4,115,232	51,062	12,357,004
1948	22,638	5,214,366	82,734	7,178,969	16,918	6,056,644	43,821	11,656,386
1949	26,910	5,020,076	82,522	6,407,589	19,858	6,275,128	44,033	10,920,184
1891–1949	1,518,305	135,234,105	9,127,554	426,499,697	1,169,856	160,507,911	4,810,150	681,465,272

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both [illegible]

the average price for all grades.

Tenor of lead and zinc ore, old tailings, and slimes milled and concentrates produced in Oklahoma, 1948–49

	1948		1949	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled......short tons..	2,228,294	2,110,010	2,543,835	1,050,586
Total concentrates produced:				
Galena......do....	22,507	131	26,884	26
Sphalerite......do....	73,899	8,835	77,262	5,260
Ratio of concentrates to ore, etc.:				
Lead......percent..	1.01	0.006	1.06	0.002
Zinc......do....	3.32	.42	3.04	.50
Metal content of ore, etc.:[1]				
Lead......do....	.77	.003	.80	.001
Zinc......do....	1.95	.24	1.80	.29
Average lead content of galena concentrates......do....	76.40	50.38	75.32	57.69
Average zinc content of zinc concentrates......do....	58.91	58.25	59.35	58.29
Average value per ton:				
Galena concentrates......	$230.81	$149.34	$186.60	$138.08
Zinc concentrates......	$86.61	$88.13	$76.82	$89.76

[1] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.

The 15,000-ton Central mill of the Eagle-Picher Mining & Smelting Co. at Cardin treats company and custom ores from Oklahoma, Kansas, and Missouri. In 1949 the mill operated at one-half to two-thirds capacity, except during July and the first week in August, when it was closed by a work stoppage. The mill equipment includes differential-density (sink-and-float) preliminary-concentration units, which furnish an enriched product for treatment by jigging and flotation. The mill feed in 1949 totaled 2,550,638 tons, of which 68 percent came from Oklahoma. Eagle-Picher mines in Oklahoma shipping to the mill were the Big Chief, Blue Goose mines, Buffalo, Crawfish, Goodeagle No. 3, Goodwin, Gordon No. 2, Grace Walker No. 2, Hum-bah-wat-tah mines, John Beaver No. 2, Kenoyer mines, Lottson No. 2, Netta No. 2, Piokee, Royal, See Sah, Slim Jim-Bankard, Swift, Vantage, Wesa, White, and Wilson.

The leading Oklahoma custom shippers to the Central mill (in order of tonnage) were the Federal Mining & Smelting Co. (Gordon, Lucky Syndicate-Howe-Ohimo mines), and the W. M. & W. (Velie Nos. 1 and 2, Little Greenback), Frank Hudson (Craig, Bingham), F. W. Evans (Shorthorn), Tom Kiser (Wesa Greenback, Little Greenback), Jake Dryer (Southside), C. G. & C. (Lucky Bill), Mahutska (Jeff City No. 2, Eudora), Little Bill, Tongaha (Tongaha-Anna Beaver), Carpenter (New York, Oko), Cardinal, and Hunt (Dorothy Bill) mining companies. Additional substantial shippers to the Central mill or other custom mills included the Golden Hawk mine, Brewster-Federal (M. & W.), Blackhawk, Baird-Tar Creek, DeVilliers (Nancy Jane), Crystal, Mary Whitebird (A. & A.), Discard, Dobson, Bonanza, Crutchfield, Bob White, and Aztec.

The Nellie B. Mining Co. operated its Rialto, Lawyers, and Barbara J. mines and mills throughout 1949. The three mills together have a capacity of 2,500 tons daily. Production rates were lower after metal prices began to decline in March. The Harris Mining Co. operated the Farmington mine and Lucky Jenny mill continuously.

The C. & M. Mining Co. operated its No. 4 (Imbeau) mine and mill throughout the year. The Scott mill and the Scott and Mary Ann mines were in production about 9 months. The United Zinc Smelting Corp. Royal mill (treating company and custom ore) operated during the first part of the year. The Federal Quapaw-Davenport mine, operated from January 1 to June 14, was the principal custom shipper to the Royal mill. The Mission mill ran on custom ore throughout the year; the Dewey Sims Pelican mine was the largest shipper to the mill. The Park Walton mine and mill closed February 1.

The Sooner Mining Co. operated its tailing mill throughout 1949. The Big Chief, Cardin (Western), and Britt & Britt tailing mills operated from 2 to 4 months during the first half of the year. The Eagle-Picher Bird Dog mill operated on slimes.

KANSAS

The Kansas zinc-lead mining areas are in the southeastern corner of the State and comprise part of the Tri-State district. General details of the Tri-State mining industry are given in a foregoing section. Mines in Kansas produced 37 percent of the Tri-State total output of zinc in 1949 and 42 percent in 1948. A 17-percent decrease from 1948 in the Kansas output accounted for most of the 7-percent decline in the total Tri-State output of zinc. Lead production in Kansas in 1949 increased 17 percent over 1948 and was the largest since 1941.

Mine production of lead and zinc in Kansas, 1945–49, and total, 1876–1949

Year	Mines producing	Lead concentrates		Zinc concentrates		Metal content [1]			
						Lead		Zinc	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945	82	9,967	$1,236,322	89,305	$9,715,271	7,370	$1,267,640	48,394	$11,130,620
1946	82	8,499	1,388,210	87,963	9,902,906	6,445	1,405,010	47,703	11,639,532
1947	79	9,600	1,811,269	76,699	7,641,709	7,285	2,098,080	41,497	10,042,274
1948	79	11,090	2,592,500	66,340	5,833,441	8,386	3,002,188	35,577	9,463,482
1949	70	12,973	2,463,056	54,969	4,262,380	9,772	3,087,952	29,433	7,299,384
1876–1949	------	771,885	60,657,148	5,115,421	230,477,919	589,010	72,825,009	2,653,971	360,218,048

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

The Baxter Springs-Blue Mound-Treece area has produced most of the Kansas output of zinc and lead since 1918; in 1949 this area contributed 95 percent of the total State output of zinc concentrates and 92 percent of the lead concentrates. About 59 percent of the crude ore mined in the area was concentrated in the Central mill of the Eagle-Picher Mining & Smelting Co. at Cardin, Okla. Most of the ore was transported to the mill over the Northeast Oklahoma Railroad, which has spur tracks to the principal ore-hoisting shafts. Producing Eagle-Picher mines in this area were the Big John, Foley No. 3, Mullen, Webber, Westside No. 2, and Wilbur.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1948–49

	1948		1949	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore and old tailings milled short tons	1,788,298	471,498	1,602,976	544,034
Total concentrates produced:				
Galena do	11,090		12,951	22
Sphalerite do	63,697	2,643	52,245	2,724
Ratio of concentrates to ore, etc.:				
Lead percent	0.62		0.81	0.004
Zinc do	3.56	0.56	3.26	.50
Metal content of ore, etc.:[1]				
Lead do	.48		.62	.002
Zinc do	2.12	.33	1.94	.29
Average lead content of galena concentrates do	77.16		76.87	57.58
Average zinc content of sphalerite concentrates do	59.56	59.60	59.59	57.64
Average value per ton:				
Galena concentrates	$233.77		$190.02	$95.55
Sphalerite concentrates	$87.64	$94.89	$78.08	$67.21

[1] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.

The Walter Hartley mine of the National Lead Co., St. Louis Smelting & Refining Division near Baxter Springs, was again the largest individual mine producer of zinc in Kansas and the Tri-State district. Highly selective mining, which will result in a shorter life for the mine, was necessary after the sharp decline in the price of zinc. The ore from this mine and other company mines (Ballard, Moore, and Shanks) was treated in the company No. 8 (Ballard) central mill. The mill also treated custom ore from the Bailey, Bonanza, and Liza Jane mines.

The Dines Mining Co. operated its mill and the Hartley No. 1 and Stoskopf mines most of the year. Besides company ore, the mill treated custom ore from the C. K. & E. (Stebbins, Karcher), and Roanoke (Homestake) mines. The Beck Mining Co. No. 3 mill operated about 10 months, mostly on ore from the company Swalley mine, the MacArthur mines, and the Contact mine; smaller tonnages were received from the Ninety-Six, Brewster No. 6, and Jones mines. The Fox Mining Co. reopened the Robinson (formerly Youngman) mill and the Robinson mine and operated them from February 1 to June 15. The Wade-Rea mill ran all the year, treating company and custom ore. The M. & W. mill treated custom ore from the Liza Jane, F. & G. (Lindsay-State Line), Brewster-Federal, Athletic, High Five (Murphy, at Galena), and 10 other small producers.

The Bilharz Mining Co. Muncie mine was among the larger shippers of custom ore to the Eagle-Picher Central mill. Other shippers included the Ebenstein, Grace Jarrett (Wright), Mark Twain (Blue Mound-Blue Diamond, Naylor), Robinson (Douthit, Jarrett), Bob White (Chubb, Cherokee, Kansouri), A. & H. (Bendelari), Linda Lou (Northern), and Race Track. The Harris Mining Co. operated the Golden Rod mine. The Captain tailing mill operated 3 months. Old tailings from Kansas were treated in the Sooner mill in Oklahoma. The Barr Cleanup (Lucky Seven) mill ran 5 months. In June the Lavrion Mining Co. ceased work on unwatering and developing the

Garrett property, begun in 1948. The Bureau of Mines began work on an exploratory drilling project in the Melrose area November 2 and completed it March 18, 1950.

In the Crestline and Waco (Kansas part) areas F. W. Evans operated the Crutchfield and American mines at Crestline and his mill at Waco from January through March. Glen Richey operated the Grasselli mine at Waco part of the year.

Mines at Galena shipped ore to custom mills in other areas. The principal producer, the Murphy open-pit mine of Childress-Murphy Mines, Inc., was closed May 7. Other producers included the L. & S. (Cooper Hollow, Cornwall) mines; the Rummery, Turner-Rosenberry (Childress), and Alexander leases; and many small-scale individual lead-mining operations. The Eagle-Picher lead smelter and lead- and zinc-pigment plant at Galena purchases most of the lead concentrates produced in the Tri-State district.

ARKANSAS

The only activity in lead and zinc mining reported in Arkansas in 1949 was in the Ponca district, Newton County. Ore shipped totaled 6 tons containing 1 ton of recoverable zinc and 1 ton of lead. The ore comprised 1 lot each of zinc ore and lead ore from the Primrose mine, and 1 lot of zinc ore from the Brewer. In 1948 the State output was 31 tons of recoverable zinc and 22 tons of lead.

Montana

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. Needham and Paul Luff

GENERAL SUMMARY

NONE of the five major nonferrous metals in Montana in 1949 equaled the yield in 1948. Gold output declined 28, silver 9, copper 3, lead 2, and zinc 8 percent. Ore production was 14 percent less than in 1948. As a result of reductions in base-metal prices, as well as in the output of all five metals, the value of each metal was considerably less than in 1948—gold 28 percent less, silver 9, copper 12, lead 14, and zinc 14. This resulted in an over-all drop of 13 percent in total value—from $56,422,609 in 1948 to $49,003,447 in 1949. Of the total value in 1949, copper contributed 46 percent, zinc 27, lead 12, silver 11, and gold 4.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1945–49 and total, 1862–1949, in terms of recoverable metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	160	26	4,919,562	44,597	$1,560,895	5,942,070	$4,225,472
1946	193	42	2,234,958	70,507	2,467,745	3,273,140	2,644,697
1947	243	54	3,100,013	90,124	3,154,340	6,326,190	5,725,202
1948	250	34	3,020,307	73,091	2,558,185	6,930,716	6,272,648
1949	281	48	2,595,934	52,724	1,845,340	6,327,025	5,726,277
1862–1949			(1)	17,268,060	388,835,312	768,733,754	564,800,179

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	88,506	$23,896,620	9,999	$1,719,828	17,403	$4,002,690	$35,405,505
1946	58,481	18,947,844	8,280	1,805,040	16,770	4,091,880	29,957,206
1947	57,900	24,318,000	16,108	4,639,104	45,679	11,054,318	48,890,964
1948	58,252	25,281,368	18,411	6,591,138	59,095	15,719,270	56,422,609
1949	56,611	22,304,734	17,996	5,686,736	54,195	13,440,360	49,003,447
1862–1949	6,751,116	1,973,704,776	747,515	94,181,614	2,021,257	329,636,790	3,351,158,671

[1] Figure not available.

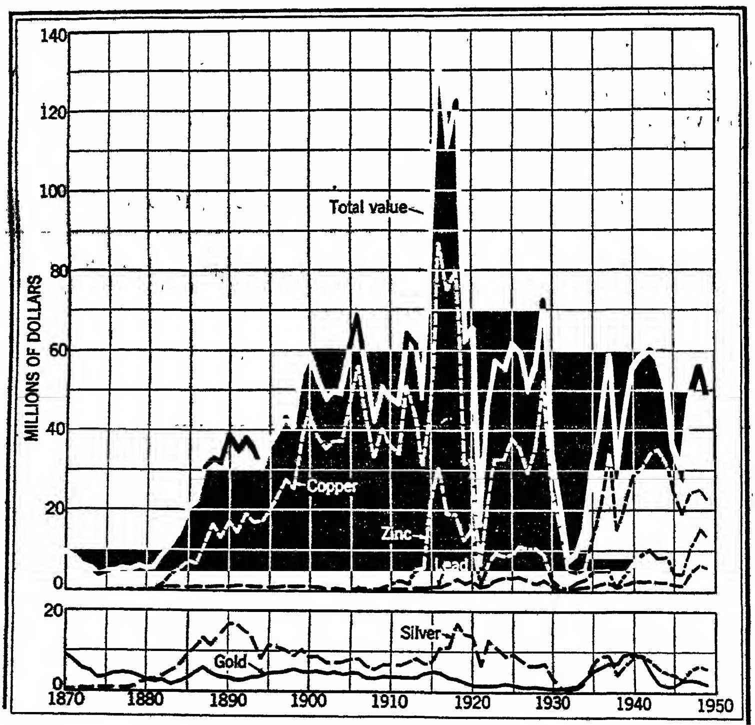

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc, and total value in Montana, 1870–1949.

Gold produced at placer mines in Montana, 1945–1949, by classes of mines and by methods of recovery

Class and method	Mines producing	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average value per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucket-line dredges:					
1945	2	1,497,646	9,181	$321,335	$0.215
1946	4	4,621,073	21,609	756,315	.164
1947	5	5,398,575	21,749	761,215	.141
1948	4	3,523,306	13,932	487,620	.138
1949	2	2,604,905	7,758	271,530	.104
Dragline dredges:					
1945	2	33,500	359	12,565	.375
1946	4	808,100	4,706	164,710	.204
1947	3	478,194	2,329	81,515	.170
1948	3	57,850	299	10,465	.181
1949	----------	----------	----------	----------	----------
Becker-Hopkins dredges:					
1946 [1]	1	5,000	32	1,120	.224
1947–49	----------	----------	----------	----------	----------
Nonfloating washing plants: [2]					
1945	1	3,000	30	1,050	.350
1946	2	320,000	1,354	47,390	.148
1947	6	185,050	2,883	100,905	.545
1948	8	707,700	2,177	76,195	.108
1949	13	409,545	1,855	64,925	.159
Gravel hydraulically handled:					
Hydraulic:					
1945	2	420	8	280	.667
1946	6	6,950	87	3,045	.438
1947	1	15,680	195	6,825	.435
1948	1	750	48	1,680	2.240
1949	2	1,500	53	1,855	1.237
Small-scale hand methods:					
Wet:					
1945	19	4,165	112	3,920	.941
1946	23	5,695	96	3,360	.590
1947	37	13,795	155	5,425	.393
1948	16	3,805	66	2,310	.607
1949	29	7,395	152	5,320	.719
Underground placers:					
Drift:					
1945	----------	----------	----------	----------	----------
1946	2	2,540	102	3,570	1.406
1947	2	2,315	123	4,305	1.860
1948	2	200	19	665	3.325
1949	2	27	3	105	3.889
Grand total placers:					
1945	26	1,538,731	9,690	339,150	.220
1946	42	5,769,358	27,986	979,510	.170
1947	54	6,093,609	27,434	960,190	.158
1948	34	4,293,611	16,541	578,935	.135
1949	48	3,023,372	9,821	343,735	.114

[1] First year for which this method was reported used in Montana.

[2] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."

Mine production of gold, silver, copper, lead, and zinc in Montana in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	3,315	606,695	4,600	1,665	5,710
February	3,380	568,345	5,495	1,741	5,520
March	4,445	646,135	5,750	1,905	6,195
April	4,615	620,075	5,210	1,545	5,255
May	5,055	659,495	5,175	1,530	5,725
June	4,525	453,785	4,230	1,460	4,245
July	4,680	419,455	3,960	1,310	3,660
August	4,270	469,815	4,035	1,390	3,725
September	4,110	361,090	3,790	1,135	2,685
October	4,145	424,680	4,335	1,355	3,175
November	4,344	490,020	4,761	1,305	3,710
December	5,840	607,435	5,270	1,655	4,590
Total: 1949	52,724	6,327,025	56,611	17,996	54,195
1948	73,091	6,930,716	58,252	18,411	59,095

Gold.—Gold output in Montana in 1949 decreased from both lodes and placers. Among the larger gold-producing properties, only the Estelle-New Year's Gift group and the Cornucopia mine reported larger gold yields in 1949 than in 1948. Declines were pronounced at the Butte operations of the Anaconda Copper Mining Co., Drumlummon, Ruby, U. S. Grant, and Golden Sunlight mines, H. & H. Mines dredge, and Porter Bros. dredge. Of the State gold in 1949, 49 percent was derived from gold and silver ores (40 percent in 1948), 32 percent from base-metal ores (37 percent in 1948), and 19 percent from placers (23 percent in 1948). Ores milled yielded 60 percent of the total gold, and ores shipped to smelters nearly 22 percent.

Gold producers in Montana, each with an output of 1,800 ounces or more in 1949, were the properties of the Anaconda Copper Mining Co. (copper ore and waste materials and zinc-lead ore and dumps) at Butte, Estelle-New Year's Gift group (gold ore) in Park County, Porter Bros. (dredge) at Helena, Drumlummon mine (gold ore) at Marysville, Cornucopia mine (gold-silver ore) near Virginia City, Ruby mine (gold ore) in Phillips County, H. & H. Mines (dredge) in Granite County, and Golden Sunlight mine (gold ore) near Whitehall. From these eight properties came 77 percent of the total gold in 1949.

Silver.—Output of silver at the Butte Hill mine and dumps of the Anaconda Copper Mining Co. was 7 percent lower in 1949 than in 1948. Yield of the metal was slightly greater from copper ore but considerably less from zinc-lead ore. The property contributed 83 percent of the State total silver in 1949, followed by the Emma mine at Butte and the Mike Horse mine at Flesher. These three furnished 89 percent of the total silver.

Zinc-lead ore supplied 62 percent of the State silver in 1949, copper ore 29, gold and silver ore 7, and lead and zinc ores together 2 percent. Ores milled yielded 91 percent of the total silver, and smelting ores almost 9 percent; minor sources were placers and old zinc slag fumed.

Copper.—Yield of copper in 1949 increased from zinc-lead ore but declined from copper ore produced at the Butte Hill mine and dumps

of the Anaconda Copper Mining Co. Reduced output from the copper ore resulted mainly from curtailment of operations following sharp breaks in the price of copper beginning in March. The company contributed over 98 percent of the State copper in 1949.

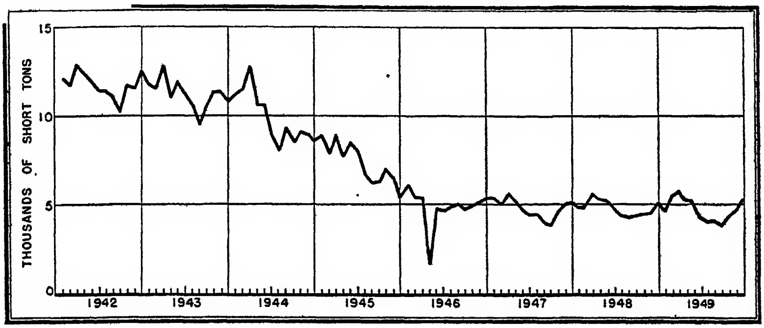

FIGURE 2.—Mine production of copper in Montana, 1942–49, by months, in terms of recoverable metal.

Lead.—The leading factor in the decline of lead output in Montana in 1949 was the 17-percent decrease in production of the metal from zinc-lead ore produced by the Anaconda Copper Mining Co. from its Butte Hill mine and dumps. Output of lead also declined from the Emma mine, but the Mike Horse and Jack Waite mines reported substantial increases. However, the Mike Horse mine closed in December, owing to low prices of lead and zinc. The Anaconda Copper Mining Co. produced 45 percent of the State lead in 1949; other operations that produced more than 2 million pounds of recoverable lead each were the Emma, Mike Horse, and Jack Waite mines. These four furnished 79 percent of the total lead. Of the total lead, 84 percent was recovered from zinc-lead ore, 10 percent from lead ore, 3 percent from gold and silver ores, and 3 percent from zinc ore and old slag.

Zinc.—Zinc production in 1949 declined 8 percent at the Butte Hill mine and dumps; decreases were particularly marked from June through September, following marked drops in the price of the metal. Declines were also reported from the Emma mine and the old slag pile at East Helena, but large gains were made at the Mike Horse and Travona mines. Leading State zinc producers in 1949, each with an output of more than a million pounds of recoverable zinc, were the Butte Hill mine and dumps (72 percent of the State total), Emma and Mike Horse mines, East Helena old slag dump, an old slag dump in Cascade County, and the Travona mine, which together furnished 97 percent of the total. Of Montana zinc in 1949, 93 percent was derived from zinc-lead ore, 5 percent from zinc ore and old slag, and nearly all the remainder from gold and silver ores and lead ore.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Montana in 1949, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Beaverhead	31	3	1,537	$53,795	59,316	$53,684
Broadwater	32	9	1,314	45,990	24,824	22,467
Cascade	8		162	5,670	81,644	73,892
Deer Lodge	3	1	500	17,500	674	610
Fergus	1		20	700	74	67
Granite	15	8	2,314	80,990	24,497	22,171
Jefferson	62		3,212	112,420	104,381	94,470
Judith Basin	1		4	140	3,665	3,317
Lewis and Clark	26	10	12,231	428,085	173,766	157,267
Lincoln	5	1	2	70	211	191
Madison	50	3	5,259	184,065	112,744	102,039
Meagher	2	1	30	1,050	94	85
Mineral	2	3	46	1,610	27,846	25,202
Missoula	7		20	700	1,453	1,315
Park	7	2	7,075	247,625	35,324	31,970
Phillips	2		2,464	86,240	15,514	14,041
Powell	8	4	593	20,755	8,742	7,912
Ravalli	1	2	155	5,425	6,107	5,527
Sanders	4		29	1,015	10,037	9,084
Silver Bow	14	1	15,757	551,495	5,636,112	5,100,966
Total: 1949	281	48	52,724	1,845,340	6,327,025	5,726,277
1948	250	34	73,091	2,558,185	6,930,716	6,272,648

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaverhead	24,500	$4,826	1,240,500	$195,999	102,500	$12,710	$321,014
Broadwater	3,200	630	213,800	33,780	211,500	26,226	129,093
Cascade	64,800	12,766	1,363,700	215,465	3,271,900	405,716	713,509
Deer Lodge	4,000	788	1,700	269	1,600	198	19,365
Fergus	200	39	11,800	1,864			2,670
Granite	4,000	788	58,400	9,227	55,200	6,845	120,021
Jefferson	32,000	6,304	1,039,500	164,241	649,700	80,563	457,998
Judith Basin	600	118	71,600	11,313	40,500	5,022	19,910
Lewis and Clark	287,800	56,697	5,444,200	860,184	7,284,000	903,216	2,405,449
Lincoln	100	20	20,300	3,207	15,000	1,860	5,348
Madison	349,900	68,930	320,700	50,671	46,800	5,803	411,508
Meagher			6,300	995	1,700	211	2,341
Mineral	23,500	4,630	193,500	30,573	172,400	21,378	83,393
Missoula	2,400	473	520,400	82,223	9,000	1,116	85,827
Park	495,500	97,614	236,800	37,414	115,800	14,359	428,982
Phillips							100,281
Powell	3,500	689	163,700	25,865	30,100	3,732	58,953
Ravalli	3,000	591	46,800	7,394	110,900	13,752	32,689
Sanders	32,500	6,402	2,058,700	325,275	308,300	38,229	380,005
Silver Bow	111,890,500	22,042,429	22,979,600	3,630,777	95,963,100	11,899,424	43,225,091
Total: 1949	113,222,000	22,304,734	35,992,000	5,686,736	108,390,000	13,440,360	49,003,447
1948	116,504,000	25,281,368	36,822,000	6,591,138	118,190,000	15,719,270	56,422,609

MINING INDUSTRY

Active lode mines in Montana increased 12 percent from 250 in 1948 to 281 in 1949; active placer mines increased 41 percent in number, even though the output of placer gold decreased 41 percent from that in 1948. Declining base-metal prices during the spring and summer resulted in the closing of a number of small properties and a few of the larger; however, the main effect was one of curtailment. At the Butte properties of the Anaconda Copper Mining Co. a 5-day work week went into effect early in June, underground mining was reduced,

shipments of zinc-lead dump ore ceased, and work on the Greater Butte project was temporarily suspended. But at mid-November, copper mining at the Belmont mine, shipping of zinc-lead dump ore, and sinking of the Kelly shaft were resumed. Of particular note over the State was the shift during the year of operators from small properties producing base-metal ores to those producing gold and silver ores, as base-metal mining became less profitable.

Copper ore mined in the State in 1949 declined 19 percent, zinc-lead, zinc, and lead ores 7, and gold and silver ores 22. Of the 2,595,934 tons of ore treated during the year (3,020,307 in 1948), 47 percent was copper ore (50 percent in 1948), 46 percent was zinc-lead, zinc, and lead ores (43 percent in 1948), and 7 percent was gold and silver ores (7 percent in 1948).

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Montana in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold ore	88	116,299	21,263	68,471	844,843	84,458	17,577
Dry gold-silver ore	33	15,801	3,624	107,075	9,398	178,124	173,929
Dry silver ore	52	37,190	1,147	259,378	75,416	669,932	803,421
Total	173	169,290	26,034	434,924	929,657	932,514	994,927
Copper ore	11	1,231,266	5,027	1,845,783	[1] 105,708,559		
Lead ore	87	21,248	1,312	93,039	38,062	3,746,277	317,721
Lead-copper ore	1	3		171	165	1,051	
Zinc ore	2	[2] 34,100	99	55,393	104,213	1,213,387	5,889,208
Zinc-lead ore	46	1,140,027	10,431	3,896,726	6,441,344	30,098,771	101,188,144
Total lode mines	[3] 281	2,595,934	42,903	6,326,036	[1] 113,222,000	35,992,000	108,390,000
Placers	48		9,821	989			
Total: 1949	329	2,595,934	52,724	6,327,025	[1] 113,222,000	35,992,000	108,390,000
1948	284	3,020,307	73,091	6,930,716	[4] 116,504,000	36,822,000	118,190,000

[1] Includes 4,419,019 pounds recovered from precipitates.
[2] Includes 14,585 tons of zinc slag fumed.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[4] Includes 5,503,688 pounds recovered from precipitates.

METALLURGIC INDUSTRY

The 2,595,934 tons of ore produced from Montana lode mines in 1949 were treated as follows: 2,464,870 tons (95 percent) at mills (2,893,171 tons in 1948); 116,479 tons (4 percent) shipped to smelters (104,409 tons in 1948); and 14,585 tons (0.56 percent) of old lead-smelter slag fumed (22,727 tons in 1948).

The 12,320-ton copper concentrator and the 2,000-ton zinc concentrator of the Anaconda Copper Mining Co. at Anaconda operated continuously in 1949. The company copper smelter (annual capacity, 1,300,000 tons of charge) and the two electrolytic-zinc plants at Anaconda and Great Falls (combined capacity 233,400 tons of slab zinc per year) also were operated throughout the year. The zinc plants treated 533,964 tons of zinc concentrates from many sources

containing 563,625,671 pounds of zinc, compared with 511,119 tons containing 543,164,009 pounds of zinc in 1948. The company slag-fuming plant at East Helena was operated all year and treated 222,875 tons of hot slag and old cold slag compared with 221,754 tons in 1948; output of zinc-lead fume increased from 35,781 tons in 1948 to 36,827 tons in 1949; nearly all of it was treated at the Great Falls electrolytic zinc plant.

The lead smelter of the American Smelting & Refining Co. at East Helena operated throughout 1949 and treated chiefly lead-silver concentrates from Idaho, residues from the electrolytic zinc plants at Anaconda and Great Falls, and crude ores, concentrates, and old tailings from various districts in Montana.

Mine production of metals in Montana in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	4,284	2,581			
Ore cyanided	2,524	11,449			
Concentrates smelted [1]	24,613	5,763,802	106,298,126	30,312,039	101,306,995
Copper precipitates smelted			4,419,019		
Ore smelted	11,478	542,345	2,502,695	5,359,766	4,158,877
Old slag fumed	4	5,859	2,160	320,195	2,924,128
Placer	9,821	989			
Total: 1949	52,724	6,327,025	113,222,000	35,992,000	108,390,000
1948	73,091	6,930,716	116,504,000	36,822,000	118,190,000

[1] Includes zinc concentrates treated at electrolytic plants.

Gross metal content of Montana ore treated at mills in 1949, by classes of ore [1]

Class of ore	Ore (short tons)	Gross metal content of mill feed				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	105,564	20,453	100,465	1,246,060	23,750	11,615
Dry gold-silver	1,601	79	1,600	600	19,600	13,400
Dry silver	2,260	205	25,080	21,285	40,000	26,750
Copper	1,204,471	5,403	1,911,575	105,441,510		
Lead	10,224	8	1,657	3,000	627,000	12,700
Zinc	2,483	25	13,417	53,093	42,070	422,108
Zinc-lead	1,138,267	15,023	4,806,535	8,219,990	35,879,591	118,262,140
Total: 1949	2,464,870	41,196	6,860,329	114,985,538	36,632,011	118,748,713
1948	3,893,171	57,157	7,751,577	120,458,183	40,987,047	127,270,191

[1] Exclusive of copper ore by leaching.

Mine production of metals from mills in Montana in 1949, by counties, and by classes of concentrates smelted, in terms of recoverable metals

	Material treated (short tons)	Recoverable in bullion		Concentrates smelted and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Beaverhead	3,168	98	7						
Broadwater	3,406	93	53	217	69	4,330	569	66,504	129,952
Cascade	15,499			1,098	95	42,515	5,000	511,058	715,906
Deer Lodge	360	226	5						
Granite	530	9	1	47		2,747	2,180	10,453	16,940
Jefferson	5,635	410	1,220	40	21	770	179	7,651	2,011
Lewis and Clark	69,807	3,573	2,406	7,554	1,314	141,527	257,444	4,691,100	4,061,409
Lincoln	135			17		128		11,225	12,600
Madison	26,508	33	16	2,317	1,309	8,164	344,200	3,348	550
Mineral	10,610			381	38	27,846	23,500	193,500	172,400
Missoula	10,144			594	1	1,347	2,100	519,400	7,600
Park	45,309	225	32	3,010	6,734	25,401	490,494	71,880	78,445
Phillips	14,875	2,066	10,231						
Powell	225			11	3	265	218	3,973	1,599
Ravalli	1,500			149	43	6,097	3,000	46,800	110,900
Sanders	5,509			1,256	20	6,994	15,043	1,481,451	271,992
Silver Bow	2,251,650	75	59	434,909	14,966	5,495,671	109,573,218	22,693,696	95,724,691
Total: 1949	2,464,870	6,808	14,030	451,600	24,613	5,763,802	110,717,145	30,312,039	101,306,995
1948	2,893,171	13,528	12,475	425,768	29,557	6,318,126	115,553,229	33,146,727	110,143,059
BY CLASSES OF CONCENTRATES SMELTED									
Dry gold				19	92	176		603	85
Dry gold-silver				61	1,070	19,189	2,844	6,100	6,822
Copper				216,667	12,513	1,823,626	103,196,792		
Lead				18,599	1,981	985,939	2,017,880	19,455,593	2,120,917
Lead-copper				39	1	2,435	3,000	21,895	3,945
Zinc				102,050	6,890	2,496,725	3,712,633	10,686,825	99,113,436
Zinc-lead				144	59	4,289	1,210	78,885	40,660
Zinc-lead-copper				114	32	14,804	21,315	62,138	21,130
Dry iron (from coppe , zinc, zinc-lead ore)				113,907	1,975	416,619	1,761,471		
Total 1949				451,600	24,613	5,763,802	110,717,145	30,312,039	101,306,995

Gross metal content of concentrates produced from ores mined in Montana in 1949, by classes of concentrates smelted

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	19	92	176		617	143
Dry gold-silver	61	1,070	19,189	3,290	6,224	8,495
Copper	216,667	12,513	1,823,626	106,391,171		
Lead	18,599	1,981	985,939	2,373,983	19,792,011	2,602,418
Lead-copper	39	1	2,435	3,576	22,192	4,950
Zinc	102,050	6,890	2,496,998	3,908,541	11,253,117	101,158,636
Zinc-lead	144	59	4,289	1,462	80,426	47,816
Zinc-lead-copper	114	32	14,804	24,785	63,214	26,000
Dry iron (from copper, zinc, zinc-lead ore)	113,907	1,975	416,619	1,815,950	1,770,292	7,455,409
Total: 1949	451,600	24,613	5,764,075	114,522,758	32,988,093	111,303,867
1948	425,768	29,557	6,318,126	119,366,384	36,032,022	118,665,664

Gross metal content of Montana crude ore shipped to smelters in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	10,735	5,326	11,541	8,498	68,104	22,102
Dry gold-silver	14,200	3,565	105,866	10,508	168,146	205,161
Dry silver	34,930	976	237,926	67,527	649,682	962,122
Copper	26,795	174	41,643	2,376,930		
Lead	11,024	1,308	91,599	44,895	3,289,350	443,558
Lead-copper	3		171	193	1,071	120
Zinc	17,032	77	38,730	72,344	874,711	3,199,271
Zinc-lead	1,760	52	14,869	28,137	413,979	348,572
Total: 1949	116,479	11,478	542,345	2,609,032	5,465,043	5,180,906
1948	104,409	13,465	588,597	1,009,584	3,292,170	4,415,782

Mine production of metals from Montana crude ore shipped to smelters in 1949, in terms of recoverable metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Beaverhead	6,586	1,193	59,277	24,500	1,240,500	102,500
Broadwater	1,871	956	20,409	2,631	147,296	81,548
Cascade	16,825	67	39,129	59,800	852,642	2,555,994
Deer Lodge	418	201	659	4,000	1,700	1,600
Fergus	42	20	74	200	11,800	
Granite	1,258	141	21,592	1,820	47,947	38,260
Jefferson	23,486	2,781	102,391	31,821	1,031,849	647,689
Judith Basin	144	4	3,665	600	71,600	40,500
Lewis and Clark	3,999	452	23,237	28,196	432,905	298,463
Lincoln	32	1	83	100	9,075	2,400
Madison	13,036	3,837	104,553	5,700	317,352	46,250
Meagher	17		94		6,300	1,700
Missoula	43	19	106	300	1,000	1,400
Park	517	109	9,891	5,006	164,920	37,355
Phillips	105	398	5,283			
Powell	1,671	576	8,477	3,282	159,727	28,501
Sanders	495	9	3,043	17,457	577,249	36,308
Silver Bow	45,934	714	140,382	2,317,282	285,904	238,409
Total: 1949	116,479	11,478	542,345	2,502,695	5,359,766	4,158,877
1948	104,409	13,465	588,597	950,771	3,167,203	3,290,733
BY CLASSES OF ORE						
Dry gold	10,735	5,326	11,541	7,578	66,249	10,193
Dry gold-silver	14,200	3,565	105,866	8,980	164,899	165,388
Dry silver	34,930	976	237,926	60,557	637,570	782,255
Copper	26,795	174	41,643	2,305,522		
Lead	11,024	1,308	91,599	35,962	3,224,337	309,571
Lead-copper	3		171	165	1,051	
Zinc	17,032	77	38,730	60,115	859,323	2,604,651
Zinc-lead	1,760	52	14,869	23,816	406,337	286,819
Total 1949	116,479	11,478	542,345	2,502,695	5,359,766	4,158,877

REVIEW BY COUNTIES AND DISTRICTS

BEAVERHEAD COUNTY

Argenta District.—Ida B. Hand, owner, and lessees operated the Louis Phillip (Maulden) mine throughout the year and shipped to smelters 3,111 tons of lead ore containing 239 ounces of gold, 16,117 ounces of silver, 18,337 pounds of copper, 809,978 pounds of lead, and 110,870 pounds of zinc. Olamont Mining Co. worked the Ermont mine and treated 3,168 tons of gold ore by cyanidation. The Shafer group of claims was worked by Shafer Bros. and lessees; 664 tons of gold ore were shipped to smelters. George Fleming operated the Sylvia mine all year and shipped 202 tons of lead smelting ore containing 279 ounces of gold, 9,264 ounces of silver, 637 pounds of copper, 124,206 pounds of lead, and 4,800 pounds of zinc. Remaining district output was principally lead ore from a number of small properties.

Bryant District.—Output from the Hecla property comprised 434 tons of old silver slag, 84 tons of gold-silver ore, and 6 tons of zinc-lead ore.

Chinatown District.—Lessees operated the H & S mine part of the summer and shipped 235 tons of lead smelting ore containing 10 ounces of gold, 3,065 ounces of silver, 459 pounds of copper, 166,162 pounds of lead, and 10,000 pounds of zinc.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1949, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Beaverhead County:													
Argenta	21		7,664	1,228		1,228	30,901		30,901	15,500	1,024,500	55,900	$242,803
Bald Mountain	1		70	3		3	231		231	300	12,900	3,600	2,857
Bannack		1			1	1							35
Blue Wing	1		25				748		748	100	3,500	2,300	1,535
Bryant	1		524	42		42	3,202		3,202	4,900	36,100	32,700	15,092
Chinatown	1		235	10		10	3,065		3,065	400	163,500	8,000	30,028
Horse Prairie Creek		2			245	245		32	32				8,604
Medicine Lodge	2		9	1		1				700			173
Utopia	1		43				53		53	2,600			560
Vipond	3		1,184	7		7	21,084		21,084				19,327
Broadwater County:													
Backer	2	7	171	92	172	264	95	32	127				9,355
Beaver	11		2,042	170		170	4,707		4,707	800	83,400	35,200	27,910
Cedar Plains	12	1	884	127	1	128	14,598		14,598	1,300	46,600	45,000	30,891
Park or Indian Creek	7	1	2,190	729	23	752	5,392		5,392	1,100	83,800	131,300	60,937
Cascade County:													
Montana	7		15,516	96		96	44,108		44,108	5,000	517,500	716,700	214,901
Smelter	1		16,808	66		66	37,536		37,536	59,800	846,200	2,555,200	498,608
Deer Lodge County:													
Georgetown	2		757	427		427	379		379	3,900			16,056
French Gulch		1			73	73		10	10				2,564
Silver Lake	1		21				285		285	100	1,700	1,600	745
Fergus County: Warm Springs	1		42	20		20	74		74	200	11,800		2,670
Granite County:													
Boulder and South Boulder	5	1	844	35	32	67	8,415		8,415	3,500	29,400	23,200	18,173
Dunkleberg	1		20				359		359	200	2,900	17,000	2,930
First Chance (Garnet)	3	4	113	89	6	95	32		32				3,354
Flint Creek	4		744	10		10	15,040		15,040		25,500	15,000	19,851
Gold Creek and South Gold Creek		1			188	188		31	31				6,608
Henderson	1	2	50	1	1,938	1,939	494	126	620	300	600		68,580
Stony	1		17	15		15							525
Jefferson County:													
Amazon	1		60	3		3	379		379		800		574
Cataract	17		1,197	135		135	7,688		7,688	2,900	44,700	38,200	24,054
Clancy	9		882	36		36	7,204		7,204	1,400	32,500	24,500	16,220
Colorado	9		7,965	335		335	33,323		33,323	12,000	333,200	284,600	132,184
Elkhorn	3		5,651	203		203	48,067		48,067	8,000	225,300	241,900	117,777
Golconda	3		5,221	366		366	1,485		1,485	1,000	3,000	3,300	15,234
South Elkhorn	1		25	1		1	222		222		1,500	900	585
Whitehall	17		7,989	1,960		1,960	5,792		5,792	6,600	396,700	55,800	144,740
Wilson and Ticer Creek	2		131	173		173	221		221	100	1,800	500	6,621
Judith Basin County: Barker	1		144	4		4	3,665		3,665	600	71,600	40,500	19,910

Lewis and Clark County:													
Dry Gulch	1		4	1		1	11		11				45
Heddleston	2		57,713	81		81	104,319		104,319	242,100	4,670,600	4,052,800	1,385,445
Helena	2	5	916	46	5,842	5,888	3,676	580	4,256	1,300	12,200	69,700	220,759
Lake Helena	1		18	2		2	21		21		700	200	225
Lincoln (Poorman and McClellan Creeks)		2			999	999		157	157				35,107
Marysville	5		11,605	4,652		4,652	23,307		23,307	24,400	105,000	153,000	238,503
Missouri River		2			42	42							1,470
Rimini	7	1	1,708	333	5	338	16,198		16,198	4,200	188,500	75,500	66,462
Scratch Gravel	5		302	59		59	1,559		1,559	800	30,800	3,200	8,897
Smelter	1		14,598	6		6	5,887		5,887	2,500	331,000	2,927,300	421,314
Stemple-Gould	2		1,527	163		163	18,051		18,051	12,500	15,400	2,300	27,222
Lincoln County:													
Cabinet (Fisher River)	1		50				95		95		2,500	900	593
Leonia	2		93				73		73		12,200	13,800	3,704
Libby		1			1	1							35
Ruby Creek	1		20				32		32	100	5,100		855
Warland	1		4	1		1	11		11		500	300	161
Madison County:													
Black Tail	1		2				31		31				28
Cherry Creek	1		53	8		8	211		211				471
McCarthy Mountains	2		366	4		4	3,496		3,496	900	161,700		29,030
Norris and Norwegian	6		292	57		57	95		95		300		2,128
Pony and South Boulder	3		17	29		29	32		32				1,044
Renova (Bone Basin)	2		47	20		20	53		53		1,500		985
Rochester	8		2,009	321		321	4,266		4,266	3,100	93,500	38,300	35,229
Sheridan	10	2	1,439	91	76	167	11,205	11	11,216	1,700	62,800	8,500	27,307
Silver Star	3		25,905	1,291		1,291	8,026		8,026	344,200			120,258
Tidal Wave	4		142	175		175	400		400		700		6,598
Virginia City	9	1	9,271	3,179	4	3,183	84,918		84,918		200		188,292
Washington (Meadow Creek)	1		1	4		4							140
Meagher County:													
Beaver, Elk, and Thomas Creeks		1			30	30							1,050
Castle Mountain	2		17				94		94		6,300	1,700	1,291
Mineral County:													
Cedar and Trout Creeks		3			8	8							280
Iron Mountain (Superior)	1		5,110	4		4	12,428		12,428	400	128,100	111,900	45,583
Keystone	1		5,500	34		34	15,418		15,418	23,100	65,400	60,500	37,530
Missoula County:													
Coloma (Garnet)	2		9	17		17	21		21				614
Copper Cliff (Cramer Creek)	2		10,040				1,021		1,021	700	506,000	6,100	81,766
Elk Creek	2		34	2		2	85		85	300	1,000	1,400	538
Nine Mile	1		104	1		1	326		326	1,400	13,400	1,500	2,909
Park County:													
Emigrant Creek		2			7	7							245
New World	7		45,826	7,068		7,068	35,324		35,324	495,500	236,800	115,800	428,737
Phillips County: Little Rockies	2		14,080	2,464		2,464	15,514		15,514				100,281
Powell County:													
Finn (Washington Gulch)		2			11	11							385
Nigger Hill	3		1,326	187		187	7,984		7,984	3,400	158,200	29,800	43,131
Ophir Gulch	1	1	5	5	2	7	74		74	100	500		411
Pioneer	1	1	5	2	1	3	126		126		500	300	335
Zozell	3		560	385		385	558		558		4,500		14,691

Mine production of gold, silver, copper, lead, and zinc in Montana in 1949, by counties and districts, in terms of recoverable metals—Con.

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Ravalli County:													
Curlew	1		1,500	43		43	6,097		6,097	3,000	46,800	110,900	$28,760
Overwich (Hughes Creek)		2			112	112		10	10				3,929
Sanders County:													
Eagle	1		5,743	20		20	8,436		8,436	12,500	2,047,700	304,000	372,030
Plains	1		11				674		674		100		626
Revais Creek	1		115	9		9	116		116	19,000			4,163
Thompson River	1		135				811		811	1,000	10,900	4,300	3,186
Silver Bow County:													
Fourth of July	1		87	1		1	653		653				626
Highland	1	1	10	11	2	13							455
Melrose	1		11	1		1	358		358				359
Summit Valley (Butte)	11		2,297,476	15,742		15,742	5,635,101		5,635,101	111,890,500	22,979,600	95,963,100	43,223,651
Total Montana	281	48	2,595,934	42,903	9,321	52,724	6,326,036	989	6,327,025	113,222,000	35,992,000	108,390,000	49,003,417

Horse Prairie Creek (Colorado) District.—District production was from two placers operated by nonfloating washing plants and dragline excavators—W. C. McLeod washed 50,000 cubic yards of gravel from the Golden Leaf placer, and Charles Brenner washed 1,000 cubic yards of gravel from his property on Colorado Creek.

Vipond District.—Quartz Hill Development Co. operated its mine until June 1, when the company was dissolved; during the year the mine produced 918 tons of silver smelting ore. Remaining district production was also silver ore—234 tons from the Monte Cristo mine and 32 tons from the Silver Fawn claim.

BROADWATER COUNTY

Backer District.—All district output came from gold ore and placers, most of which was produced by A. R. Douglas, who operated a nonfloating washing plant and dragline excavator on gravels in Confederate Gulch.

Beaver District.—H. W. Carver operated the East Pacific group all year and produced 1,376 tons of gold-silver ore, which was treated in a 50-ton gravity mill on the property; in addition, 17 tons of zinc-lead ore were shipped to a smelter. Other district production was mainly 431 tons of zinc-lead ore and 106 tons of lead ore from the Kleinschmidt group, operated during the first half of the year by the Linn Mining Co. and the second half by H. W. Carver.

Cedar Plains District.—Principal output was 97 tons of lead smelting ore produced by John Luth, lessee, from the Joe Dandy claim, 116 tons of gold smelting ore from the Nada mine, 136 tons of zinc smelting ore from the Ruby Silver mine, and 405 tons of silver smelting ore from the Spar mine.

Park or Indian Creek District.—Bayles & Mosier operated the Iron Mask mine until June 10 and treated 1,400 tons of zinc-lead ore in the 50-ton flotation mill on the property. Dance & Anders, lessees, operated the Marietta mine all year and shipped 429 tons of gold smelting ore containing 658 ounces of gold, 1,671 ounces of silver, 370 pounds of copper, 13,452 pounds of lead, and 7,916 pounds of zinc. William Zimmerman worked the Silver Wave claim from October 15 to the end of the year and treated 147 tons of gold ore by table concentration.

CASCADE COUNTY

Montana District.—The Bennett Mining Co. worked the Dacotah group until the end of May, then closed for the remainder of the year because of declining metal prices. During the period of its operation, the mine produced 5,328 tons of zinc-lead ore, which was treated in the company 75-ton flotation mill. Kings Hill Mining Co. operated the Broadwater group during the first half of the year and produced 5,866 tons of zinc-lead ore which yielded 63 tons of lead concentrate and 139 tons of zinc concentrate. Lewis B. Stark, lessee, operated the Galt and Star groups and produced zinc-lead ore which yielded 203 tons of lead concentrate and 138 tons of zinc concentrate. Remaining district output was mainly 215 tons of zinc-lead milling ore from the Silver Dyke group.

Smelter District.—Metal production credited to the Smelter district in 1949 came from 16,808 tons of old smelter slag.

DEER LODGE COUNTY

Georgetown District.—District output was all gold ore—397 tons from the Pyrenees mine and 360 tons from the Gold Coin mine.

GRANITE COUNTY

Boulder and South Boulder District.—Silver ore comprised the bulk of lode production in 1949—about 500 tons from the Brooklyn group, 138 tons from Non-Pareil claim, and 176 tons from the Moonlight (Annie) group. Mining Ventures Corp. operated the Montana-Tonopah placer with a nonfloating washing plant and dragline excavator from May 1 to September 20 and recovered 32 ounces of gold from 3,000 cubic yards of gravel.

Flint Creek District.—Principal district output was made by the American Machine & Metals, Inc., from the Trout group. Production was 96 tons of lead smelting ore containing 1 ounce of gold, 3,545 ounces of silver, 16,323 pounds of lead, and 11,306 pounds of zinc; and 581 tons of silver smelting ore containing 8 ounces of gold and 10,104 ounces of silver.

Gold Creek and South Gold Creek District.—The Master Mining Co. did placer mining on upper Gold Creek and washed about 25,000 cubic yards of gravel.

Henderson District.—H. & H. Mines operated its bucket-line dredge on Henderson Creek from April 15 to December 19 and recovered 1,931 ounces of gold, 124 ounces of silver, and some tungsten concentrate from washing 700,000 cubic yards of gravel.

JEFFERSON COUNTY

Colorado District.—Main district production comprised 5,817 tons of old silver tailings from the Alta dump, 619 tons of gold-silver ore from the Blizzard dump and Margaret Ann claim, 132 tons of similar material from the Minah dump, and 1,010 tons of lead ore and 308 tons of gold-silver ore from the Mount Washington mine and dump.

Elkhorn District.—Output for the year comprised 1,630 tons of silver ore from the Elkhorn mine, 3,158 tons of old silver tailings from the Elkhorn dump, and 624 tons of lead ore, and 239 tons of gold-silver ore from the Elkhorn Queen mine.

Golconda District.—The Golconda Mining Co. operated the Buckeye (Gold Coin) group and treated 5,200 tons of gold ore in the company 80-ton cyanide plant.

Whitehall District.—Theodore Davenport operated the Perhaps mine and shipped 239 tons of lead smelting ore containing 11 ounces of gold, 466 ounces of silver, 633 pounds of copper, 31,050 pounds of lead, and 11,968 pounds of zinc. Weber & Westfall worked the Minerva mine from January to July and shipped 174 tons of lead smelting ore containing 10 ounces of gold, 514 ounces of silver, 471 pounds of copper, 45,247 pounds of lead, and 6,049 pounds of zinc. Marvin Riebhoff shipped 6,143 tons of gold ore from the Golden Sunlight mine and 129 tons of similar ore from the Blue Moose claim. Remaining district production was principally 521 tons of lead smelting ore from the Carbonate mine, 430 tons of similar ore from the Whitehall mine, and 69 tons of gold-silver ore and 80 tons of lead ore from the Parrott mine.

JUDITH BASIN COUNTY

Barker District.—Thorson & Brazee worked the Wright-Edwards (Block P) group all year and shipped 144 tons of zinc-lead smelting ore containing 4 ounces of gold, 3,665 ounces of silver, 720 pounds of copper, 72,992 pounds of lead, and 49,632 pounds of zinc.

LEWIS AND CLARK COUNTY

Heddleston District.—The Mike Horse Mining & Milling Co. operated the Mike Horse mine until December, then closed it because of low prices for lead and zinc. The company 300-ton flotation mill treated 57,710 tons of zinc-lead ore during the year containing 100 ounces of gold, 121,382 ounces of silver, 394,800 pounds of copper, 5,076,000 pounds of lead, and 4,649,200 pounds of zinc.

Helena District.—Porter Bros. operated its 6-cubic-foot bucket-line dredge in Last Chance Gulch throughout 1949 and washed 1,904,905 cubic yards of gravel. Remaining district production was mainly 910 tons of old gold-silver tailings from the Peck Concentrator dump.

Lincoln District.—Otis Williams & Co. operated a dragline dredge and nonfloating washing plant on Poorman and McClellan Creeks and washed about 250,000 cubic yards of gravel.

Marysville District.—The Montana Rainbow Mining Co. operated the Drumlummon mine and 150-ton amalgamation-flotation mill throughout the year; 10,554 tons of gold ore were treated by amalgamation in riffle boxes, followed by flotation. J. R. Reynolds and Ruth Haley operated the Shakopee mine and shipped 1,021 tons of zinc-lead smelting ore.

Rimini District.—Principal production was 413 tons of gold-silver dump ore from the Lexington group and 913 tons of lead ore and 231 tons of gold-silver ore from the Evergreen group.

Scratch Gravel District.—District output was largely 122 tons of lead smelting ore from the Franklin mine and 112 tons of gold ore from the Herb W. claim.

Smelter District.—All but a small part of the metals credited to the Smelter district came from 14,585 tons of old zinc slag treated at the East Helena slag-fuming plant of the Anaconda Copper Mining Co. and the lead blast furnace of the American Smelting & Refining Co.

Stemple-Gould District.—Swansea Mines, Inc., operated the New Silver Bell mine and produced silver ore that yielded 127 tons of lead-copper concentrate. Operations ceased in September because the 120-ton flotation mill was destroyed by fire.

MADISON COUNTY

McCarthy Mountains District.—C. O. Dale & Sons, lessees, worked the Polly Jane mine and shipped 339 tons of lead ore containing 3 ounces of gold, 3,196 ounces of silver, 1,149 pounds of copper, 161,168 pounds of lead, and 670 pounds of zinc.

Rochester District.—Jacobson & Keene, lessees, worked the Calvin mine and shipped 108 tons of lead ore containing 7 ounces of gold, 739 ounces of silver, 217 pounds of copper, 26,890 pounds of lead, and 6,008 pounds of zinc. Lessees operated the Emma group part of the year and shipped ore mostly from the dumps and tailing piles. Of the 1,244 tons shipped, 1,158 tons of gold-silver material and 6 tons

of lead ore went to smelters, and 80 tons of lead dump ore were treated by table concentration. Lessees worked the Thistle mine and produced 248 tons of gold ore.

Sheridan District.—R. J. & A. E. Shute worked the Silver Bar (Octopus) mine and shipped 840 tons of silver smelting ore. Remaining district production was principally gold ore, of which 273 tons came from the property of the Hunt Mining Co. and 177 tons from the Latest Out claim. Considerable gold was recovered from the Ihde placer.

Silver Star District.—Bulk of production was 25,878 tons of gold milling ore from the American Pit (Victoria) mine, which made 2,430 tons of copper concentrate.

Tidal Wave District.—Output was nearly all gold ore—61 tons from the Corncracker group and 46 tons from the High Ridge and High Ridge Fraction group.

Virginia City District.—The bulk of district production was gold-silver ore—2,071 tons from the U. S. Grant mine, 218 tons from the El Fleeda mine, and 162 tons from the Easton-Pacific group (all three operated by the U. S. Grant Mining Co.), and 6,714 tons from the Cornucopia mine, operated by H. A. Shute.

MEAGHER COUNTY

Beaver, Elk, and Thomas Creeks District.—Walter Walsh did hydraulicking on Elk Creek from June to October and recovered 30 ounces of gold from washing 500 cubic yards of gravel.

MINERAL COUNTY

Iron Mountain (Superior) District.—E. G. Smith, lessee, worked the dumps of the Iron Mountain mine from September 1 to November 15 and hauled 5,110 tons of zinc-lead ore to the Nancy Lee mill for treatment.

Keystone District.—E. G. Smith also worked the Nancy Lee group under lease and treated 5,500 tons of zinc-lead ore in his 100-ton flotation mill.

MISSOULA COUNTY

Copper Cliff (Cramer Creek) District.—Linton Mines operated the Blacktail open-pit mine in 1949 and built a 500-ton sink-float plant on the property, reported to be the first of its kind in the State. The mill was operated from August through November and treated 10,000 tons of lead ore which yielded 576 tons of lead concentrate.

PARK COUNTY

New World District.—McLaren Gold Mines Co. operated its open-pit Estelle-New Year's Gift group all year and treated 39,139 tons of gold ore in the company 150-ton concentration mill. Parkmont Corp. operated the Homestake mine in 1949; production was mainly gold ore treated by amalgamation and concentration, although small lots of copper ore and lead ore were shipped to smelters. Irma Mines, Inc., milled zinc-lead ore from the Irma mine; the mill yielded 54 tons of lead concentrate and 83 tons of zinc concentrate. In addition, 33 tons of zinc-lead ore, 186 tons of lead dump ore and slag, and 25 tons of silver ore were shipped from the property to a smelter.

PHILLIPS COUNTY

Little Rockies District.—The Ruby Gulch Mining Co. operated the Ruby group from May to December and treated 14,875 tons of gold ore in the company 300-ton cyanide leaching plant. In addition, 78 tons of similar ore were shipped to a smelter.

POWELL COUNTY

Nigger Hill District.—Hopkins & Sons Mining Co. operated the Charter Oak mine throughout the year and shipped 695 tons of lead smelting ore containing 77 ounces of gold, 5,858 ounces of silver, 2,945 pounds of copper, 128,046 pounds of lead, and 22,640 pounds of zinc. In addition, 225 tons of gold-silver ore were treated in the company 40-ton flotation mill. Newman Bros. operated the Lilly-Orphan Boy group all year and shipped 50 tons of gold ore, 85 tons of gold-silver ore, and 38 tons of zinc-lead ore. Silica Products Co., Inc., operated the Negros mine and shipped 233 tons of gold smelting ore.

Zozell District.—Principal district production was 518 tons of gold smelting ore from the Bonanza group. The property was operated by the Bonanza Leasing Co. and Western Mining Projects.

RAVALLI COUNTY

Curlew District.—B. F. Tout operated the Curlew mine and treated zinc-lead milling ore, which made 42 tons of lead concentrate and 107 tons of zinc concentrate.

Overwich (Hughes Creek) District.—Clarence Hogue operated a placer and recovered 109 ounces of gold and 10 ounces of silver.

SANDERS COUNTY

Eagle District.—The American Smelting & Refining Co. operated the Jack Waite mine throughout 1949 and produced 5,314 tons of zinc-lead milling ore and 429 tons of lead smelting ore. The milling ore contained 19 ounces of gold, 6,942 ounces of silver, 14,000 pounds of copper, 1,562,800 pounds of lead, and 317,800 pounds of zinc.

Revais Creek District.—The Green Mountain Mining Co. operated the Drake group intermittently until September 1, then closed because of economic conditions. Production was 115 tons of copper ore containing 10 ounces of gold, 123 ounces of silver, and 20,207 pounds of copper.

SILVER BOW COUNTY

Ore production in Silver Bow County in 1949 was 13 percent less than in 1948; output of gold declined 18 percent, silver 8, copper 3, lead 13, and zinc 9. The total value of the five metals was nearly 14 percent below that in 1948 and represented 88 percent of the State total value. The following table gives the output of mines in the county, which includes the Summit Valley (Butte) district, in 1948–49 and the total from 1882 to the end of 1949.

Production of gold, silver, copper, lead, and zinc in Silver Bow County, Mont., 1948–49, and total, 1882–1949, in terms of recoverable metals

Year	Mines producing	Ore (short tons)	Gold (lode and placer, fine ounces)	Silver (lode and placer, fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1948	22	2,637,479	19,163	6,100,232	115,423,500	26,448,900	105,250,800	$49,971,332
1949	15	2,297,584	15,757	5,636,112	111,890,500	22,979,600	95,963,100	43,225,091
1882–1949		(1)	2,080,918	562,773,334	(2) 6,714,663	(2) 270,211	(2) 1,712,089	2,734,988,313

1 Figure not available.
2 Short tons.

Summit Valley (Butte) District.—Company material treated at the copper concentrator of the Anaconda Copper Mining Co. at Anaconda comprised 1,180,750 tons of copper ore from the main Butte Hill mine (1,277,349 in 1948), 1,438 tons from the Greater Butte project (15,164 tons in 1948), and 22,198 tons of special waste (63,327 tons in 1948). Direct smelting ores totaled 39,927 tons (10,859 tons in 1948) and mine-water precipitates 3,838 tons (4,267 tons in 1948).

Production of zinc-lead ore from the Butte Hill mine of the Anaconda Copper Mining Co. was 747,962 tons in 1949 (748,957 tons in 1948) and that from the Butte Hill dumps 261,958 tons (345,539 tons in 1948). The company-operated Emma mine had an output of 27,430 tons of zinc-lead ore and middling from the treatment of manganese ore (36,150 tons in 1948). Zinc-lead middling (6,931 tons) was also produced in milling manganese ore from the Travona mine, which was treated further at the Anaconda zinc concentrator. The Poulin mine, operated under lease from the Anaconda Copper Mining Co., produced 2,483 tons of zinc-lead milling ore compared with 6,497 tons in 1948.

Remaining district output was mainly silver ore and old silver tailings—5,355 tons from the Alloy dumps, 140 tons from the Magna Charta mine, 113 tons from the Hecla claim, and 40 tons from the Nettie mine.

Nevada

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By R. B. Maurer

GENERAL SUMMARY

NEVADA lead output in 1949 was the highest in 13 years despite production curtailments due to a severe winter and operational difficulties at many mines resulting from lower prices for the metal. Zinc production, similarly affected, nevertheless was held at a relatively high level during 1949, surpassing the 1948 yield by a small margin. With large-scale copper mining dormant in all but one Nevada district, the 1949 copper output followed the trend of progressively lower yield begun in 1943 and reversed only during 1947. The persistence of operators—facing a fixed price for gold—in striving to revive State gold mining resulted in a substantially increased output of the precious metal compared with 1948. Silver, largely a byproduct metal in 1949, made a small gain over the previous year. The total value of gold, silver, copper, lead, and zinc recovered from ores, old tailings, and gravels mined at 332 lode mines and 37 placer properties was $29,615,777, compared with $34,055,480, the output of 350 lode and 36 placer mines in 1948—a decrease of 13 percent, due largely to the recession in copper.

Comparing 1949 with 1948, the gold output increased 17 percent in quantity and value; copper decreased 16 percent in quantity and 24 percent in value; silver increased 1 percent in quantity and value; lead increased 9 percent in quantity but decreased 4 percent in value; and zinc increased 1 percent in quantity but decreased 6 percent in value. Of the total value of the five metals, copper comprised 51 percent, zinc 17 percent, gold 15 percent, lead 11 percent, and silver 6 percent.

White Pine County produced 56 percent of the State total value of the five metals in 1949; it stood first in the output of copper and gold, third in lead, fourth in zinc, and fifth in silver. Lincoln County was in second place, with 27 percent of the State total value, and led the State in production of silver, lead, and zinc.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of metal production reported herein has been calculated at the prices in the accompanying table.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31. 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1945–49, and total, 1859–1949, in terms of recoverable metals

Year	Mines producing [1]		Ore, old tailings etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	163	12	5,374,673	92,265	$3,229,275	1,043,380	$741,959
1946	193	33	5,725,805	90,680	3,173,800	1,250,651	1,010,526
1947	276	31	6,541,635	89,063	3,117,205	1,377,579	1,246,709
1948	350	36	7,172,611	111,532	3,903,620	1,790,020	1,620,058
1949	332	37	5,987,013	130,399	4,563,965	1,800,209	1,629,280
1859–1949 [2]	------------	------------	(3)	25,847,995	583,241,501	594,571,520	545,222,649

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	52,595	$14,200,650	6,275	$1,079,300	21,457	$4,935,110	$24,186,294
1946	48,616	15,751,584	7,175	1,564,150	22,649	5,526,356	27,026,416
1947	49,603	20,833,260	7,161	2,062,368	16,970	4,106,740	31,366,282
1948	45,242	19,635,028	9,777	3,500,166	20,288	5,396,608	34,055,480
1949	38,058	14,994,852	10,626	3,357,816	20,443	5,069,864	29,615,777
1859–1949 [2]	1,915,571	561,166,662	574,744	69,167,867	405,189	70,061,728	1,828,860,407

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

the
306,1 [illegible]
405,189 tons, $70,061,728; total value $1,223,935,761.
[3] Figure not available.

Gold.—Increased output in 1949 from rehabilitated gold mines, notably in Esmeralda, Humboldt, and Storey Counties, was largely responsible for the 17-percent increase in Nevada gold production over 1948. The yield from placer mines decreased 3 percent, owing principally to cessation of production at the major placer mine for 8 months of 1949 while equipment was being converted. Gold from lode mines—which accounted for 94 percent of the State total gold production—increased 18 percent. The monthly production figures in the accompanying table show the adverse effect of a severe winter on gold output in January and February, followed by a fairly uniform rate of production through June. The curtailment of base-metal ore production following reduction of metal prices and resultant lowering of byproduct gold output caused the abrupt drop in July, whereas the

increased yield of gold from base-metal ores augmented by an accelerated rate of output from gold mines is reflected in the monthly totals from August through December. In 1949 byproduct gold from base-metal ores comprised 34 percent of the gold output (38 percent in 1948) whereas gold recovered from precious-metal ores was 60 percent of the total (55 percent in 1948).

The 10 leading gold producing mines in 1949 contributed 83 percent of Nevada's output, the 3 leaders producing 49 percent.

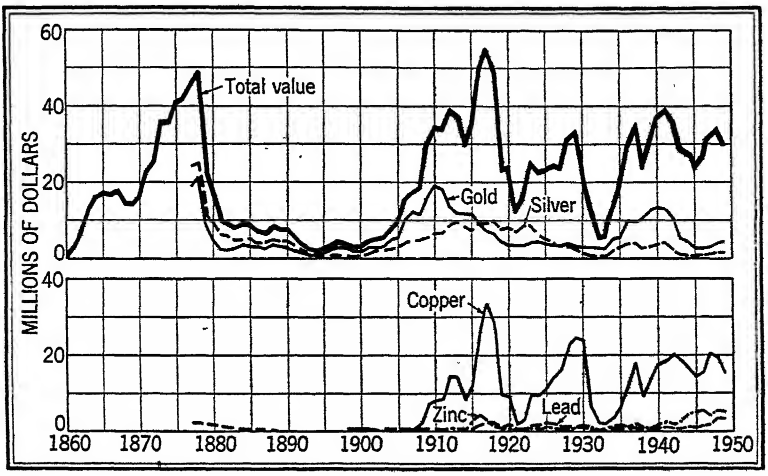

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Nevada, 1860–1949.

Silver.—Production of silver in Nevada in 1949 increased 1 percent compared with 1948; the greater yield of silver from base-metal ores and from dry gold ore more than compensated for the lower output of the metal from dry gold-silver and silver ores. Base-metal ores were the source of 57 percent of the State silver production in 1949 (52 percent in 1948), whereas 17 percent (21 percent in 1948) was from straight silver ore. Monthly production of silver, as shown in the accompanying table, reflects its role as a byproduct metal. The yield of silver follows closely the trend of base-metal output, particularly lead; low monthly production was reached in July following the year's low point in base-metal prices reached in June 1949.

Copper.—As in 1948, Nevada copper production was centered in the Robinson (Ely) district, White Pine County, where the State's two leading producers—Kennecott Copper Corp. and Consolidated Coppermines Corp.—supplied all but a small percentage of the State total 1949 output. The monthly yield from the two major mines is the background of the State total given in the accompanying table. The reduced monthly output in July, due to a lower average price for copper, was followed by increased but still curtailed production during the remainder of 1949. Data on a copper deposit were published.[1]

[1] Matson, E. J., Investigation of Table Mountain Copper Deposit, Churchill County, Nev.: Bureau of Mines Rept. of Investigations 4617, 1949, 6 pp.

Ten leading gold-producing mines in Nevada in 1949, in order of output

Rank	Mine	District	County	Rank in 1948	Operator	Source of gold
1	Pit	Robinson	White Pine	1	Kennecott Copper Corp. (Nevada Mines Division)	Copper ore.
2	Getchell & Pinson-Ogee	Potosi	Humboldt	4	Getchell Mines, Inc	Gold ore.
3	Goldacres	Bullion	Lander	2	London Extension Mining Co	Do.
4	Pit Extension & Morris Brooks	Robinson	White Pine	3	Consolidated Coppermines Corp	Copper ore.
5	Overman	Comstock	Storey	5	Consolidated Chollar, Gould, and Savage Mining Co.	Gold ore.
6	Deep Mines group	Goldfield	Esmeralda	(1)	Goldfield Deep Mines Co. of Nevada	Do.
7	Pioche group	Pioche	Lincoln	8	Combined Metals Reduction Co	Zinc-lead ore.
8	Greenan Placers	Battle Mountain	Lander	6	Natomas Co	Dredge.
9	Keystone	Comstock	Storey	25	Dayton Consolidated Mines Co	Gold ore.
10	Summit King group	Sand Springs	Churchill	9	Summit King Mines, Ltd	Gold-silver ore.

[1] Did not produce in 1948.

Ten leading silver-producing mines in Nevada in 1949, in order of output

Rank	Mine	District	County	Rank in 1948	Operator	Source of silver
1	Pioche group	Pioche	Lincoln	1	Combined Metals Reduction Co	Zinc-lead ore.
2	Copper Canyon	BattleMountain	Lander	16	Copper Canyon Mining Co	Silver ore.
3	Summit King group	Sand Springs	Churchill	2	Summit King Mines, Ltd	Gold-silver ore.
4	Overman	Comstock	Storey	3	Consolidated Chollar, Gould, and Savage Mining Co.	Gold ore.
5	Pit	Robinson	White Pine	6	Kennecott Copper Corp. (Nevada Mines Division)	Copper ore.
6	Prince	Pioche	Lincoln	4	Prince Consolidated Mining Co	Zinc-lead and silver ores.
7	Bristol	Jack Rabbit	do	5	Bristol Silver Mines Co	Lead and copper ores.
8	Central Comstock tailings	Comstock	Storey	(1)	Central Comstock Mines Co	Gold-silver tailings.
9	Cleveland	Delano	Elko	8	McFarland & Hullinger	Lead ore.
10	Ely Valley	Pioche	Lincoln	12	Ely Valley Mines, Inc	Zinc ore.

[1] Did not produce in 1948.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	6,815	97,002	3,359	647	1,418
February	7,497	127,907	2,445	739	2,127
March	10,888	175,738	4,362	993	2,297
April	12,916	178,304	4,218	1,118	2,402
May	10,338	171,665	3,571	1,015	2,103
June	10,449	152,966	2,827	889	1,549
July	8,836	132,089	1,629	671	1,294
August	11,861	148,973	3,819	956	1,176
September	13,357	158,699	3,155	1,137	1,553
October	12,469	153,452	2,998	849	1,545
November	12,001	162,443	2,859	834	1,486
December	12,972	140,971	2,816	778	1,573
Total 1949	130,399	1,800,209	38,058	10,626	20,443

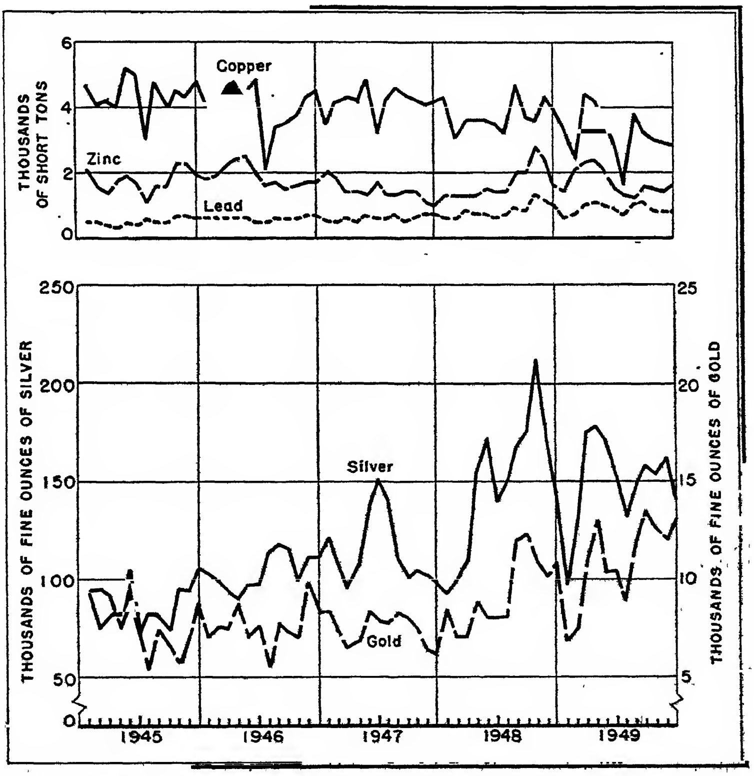

FIGURE 2.—Mine production of gold, silver, copper, lead, and zinc in Nevada, 1945–49, by months, in terms of recoverable metals.

Lead.—Of the recoverable lead produced in Nevada in 1949, 62 percent was mined in the Pioche district, Lincoln County, where its output was closely associated with the production of zinc. The leading properties were: The Pioche groups operated by Combined Metals Reduction Co., the Ely Valley mine by Ely Valley Mines, Inc., and the

Prince mine by Prince Consolidated Mining Co. The Copper Canyon mine (Copper Canyon Mining Co.), Battle Mountain district, Lander County—Nevada's second-largest producer of lead in 1949—was developed during 1948. Other important lead producers were: L. F. Jacobson, Yellow Pine mine,[2] Yellow Pine District, Clark County; and McFarland & Hullinger, Cleveland mine, Delano district, Elko County. Data on a zinc-lead-silver mine were published.[3]

Zinc.—Nevada zinc production was centered in the Pioche district and adjacent Comet district, both in Lincoln County, where 92 percent of the State total was mined. Nevada's leading producers, in the order named, were: Combined Metals Reduction Co. and Ely Valley Mines, Inc., both in the Pioche district; Copper Canyon Mining Co., Battle Mountain district, Lander County; and L. F. Jacobson (Yellow Pine mine), Yellow Pine district, Clark County. The full impact of zinc price reductions in the March–June 1949 period was not felt until August, when monthly output reached the low point of the year; output from September through December was on a curtailed basis.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1949, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold						Silver (lode and placer)	
			Lode		Placer		Total			
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Churchill	7	1	3,727	$130,445	10	$350	3,737	$130,795	179,992	$162,902
Clark	26	-------	1,049	36,715	-------	-------	1,049	36,715	24,063	21,778
Elko	26	2	220	7,700	121	4,235	341	11,935	67,578	61,161
Esmeralda	16	3	8,018	280,630	54	1,890	8,072	282,520	32,306	29,239
Eureka	11	1	68	2,380	38	1,330	106	3,710	14,597	13,211
Humboldt	15	[2] 6	21,420	749,700	[2] 4,503	[2] 157,605	[2] 25,923	[2] 907,305	[2] 5,488	[2] 4,967
Lander	21	(2)	18,186	636,510	(2)	(2)	[2] 18,186	[2] 636,510	[2] 195,010	[2] 176,494
Lincoln	25	-------	5,853	204,855	-------	-------	5,853	204,855	812,634	735,475
Lyon	27	-------	962	33,670	-------	-------	962	33,670	3,080	2,788
Mineral	23	2	1,531	53,585	12	420	1,543	54,005	26,132	23,651
Nye	36	9	1,051	36,785	795	27,825	1,846	64,610	20,740	18,770
Ormsby	1	-------	12	420	-------	-------	12	420	533	482
Pershing	13	10	2,358	82,530	2,357	82,495	4,715	165,025	15,148	13,710
Storey	14	-------	18,540	648,900	-------	-------	18,540	648,900	233,705	211,515
Washoe	4	1	308	10,780	4	140	312	10,920	129	117
White Pine	67	2	39,154	1,370,390	48	1,680	39,202	1,372,070	169,074	153,020
Total: 1949	332	37	122,457	4,285,995	7,942	277,970	130,399	4,563,965	1,800,209	1,629,280
1948	350	36	103,354	3,617,390	8,178	286,230	111,532	3,903,620	1,790,020	1,620,058

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Placer production from Lander and Humboldt Counties combined to avoid disclosure of output.

[2] Geehan, R. W., and Benson, W. J., Investigation of the Yellow Pine Zinc-Lead Mine, Clark County, Nev.: Bureau of Mines Rept. of Investigations 4613, 1949, 15 pp.
[3] Smith, M. Clair, and Trengove, Russell R., Investigation of the Rip Van Winkle Lead-Zinc-Silver Mine, Elko County, Nev.: Bureau of Mines Rept. of Investigations 4605, 1949, 13 pp.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1949, by counties, in terms of recoverable metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill			2,200	$348			$294,045
Clark	14,000	$2,758	1,165,300	184,117	894,800	$110,955	356,323
Elko	54,400	10,717	1,185,200	187,261	57,800	7,167	278,241
Esmeralda	3,400	670	129,900	20,524			332,953
Eureka	2,100	414	138,500	21,883	231,700	28,731	67,949
Humboldt	7,400	1,458	1,500	237			[2] 913,967
Lander	133,100	26,221	2,584,500	408,351	960,100	119,052	[2] 1,366,628
Lincoln	776,500	152,970	14,130,700	2,232,651	38,294,700	4,748,543	8,074,494
Lyon	15,400	3,034					39,492
Mineral	4,100	808	204,200	32,264			110,728
Nye	3,600	709	137,600	21,741	1,900	236	106,066
Ormsby	200	39	12,900	2,038			2,979
Pershing	3,200	630	55,400	8,753	69,800	8,655	196,773
Storey			400	63			860,478
Washoe			700	111			11,148
White Pine	75,098,600	14,794,424	1,503,000	237,474	375,200	46,525	16,603,513
Total: 1949	76,116,000	14,994,852	21,252,000	3,357,816	40,886,000	5,069,864	29,615,777
1948	90,484,000	19,635,028	19,554,000	3,500,166	40,576,000	5,396,608	34,055,480

[2] Placer production from Lander and Humboldt counties combined to avoid disclosure of output.

MINING INDUSTRY

The 17-percent decrease (due principally to copper ore) in total tonnage of ores and old tailings sold or treated in 1949 compared with 1948 shows an increase in dry ores and a decrease in all base-metal ores except zinc-lead ore, lead-copper ore, and zinc-lead-copper ore. The collapse of base-metal prices largely in the second quarter of 1949, followed by curtailed output of copper, lead, and zinc and corresponding retrenchment in mining-operation costs, is reflected in the mining of smaller tonnages of ores with higher base-metal content. Increased activity in gold-mining districts and concentrating silver ore for recovery of contained base metals resulted in higher output of dry and siliceous ores. Data on shaft equipment were published.[4]

Late in 1949 the bucket-line dredge of the Natomas Co. (largest producer of placer gold in Nevada) began deep dredging in the Battle Mountain district, Lander County; its output, with that of the Southwest Dredging Co. dragline and shovel equipment in the Rochester district, Pershing County, comprised a large percentage of the State placer gold. In all, 1,382,140 cubic yards of material were treated at Nevada placer mines in 1949 compared with 762,500 cubic yards in 1948, an increase of 81 percent, due largely to mechanization.

ORE CLASSIFICATION

The accompanying table classifying ores sold or treated in Nevada in 1949 shows that 82 percent of the tonnage (including old tailings) was copper ore; 11 percent gold ore and old tailings; 3 percent zinc-lead ore; 1 percent each, silver ore and old tailings, gold-silver ore and old tailings, and zinc ore; and the remainder, lead ore and old tailings, lead-copper ore, and zinc-lead-copper ore.

Details of ore classification are given in the Gold and Silver chapter of this volume.

[4] Mitchell, George W., and Johnson, A. C., Equipment at the Fad Shaft, Eureka Corp., Ltd., Eureka, Nev.: Bureau of Mines Inf. Circ. 7495, 1949, 17 pp.

Ore and old tailings sold or treated in Nevada in 1949, with content in terms of recoverable metals

Source	Material sold or treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
Dry gold ore	635,291	16,376	70,316	203,102	15,100	1,700	------------
Dry gold-silver ore	43,206	31,586	6,402	257,205	1,600	3,800	------------
Dry silver ore	80,402	200	1,250	303,316	112,900	2,686,600	960,800
Total	758,899	48,162	77,968	763,623	129,600	2,692,100	960,800
Copper ore	4,897,598	--------	38,135	133,910	[1] 75,235,500	7,000	------------
Lead ore	19,945	50	964	252,334	280,800	4,467,400	643,500
Lead-copper ore	103	--------	2	1,266	4,900	48,600	------------
Zinc ore	[2] 72,315	--------	526	[3] 51,311	[3] 120,800	[3] 800,400	[3] 10,223,500
Zinc-lead ore	189,878	--------	4,861	594,990	339,800	13,205,300	29,048,400
Zinc-lead-copper ore	63	--------	1	1,099	4,600	31,200	9,800
Total lode mines	[2] 5,938,801	48,212	122,457	[3] 1,798,533	[1,3] 76,116,000	[3] 21,252,000	[3] 40,886,000
Placers	------------	--------	7,942	1,676	------------	------------	------------
Total: 1949	[2] 5,938,801	48,212	130,399	[3] 1,800,209	[1,3] 76,116,000	[3] 21,252,000	[3] 40,886,000
1948	7,157,960	14,651	111,532	1,790,020	[4] 90,484,000	19,554,000	40,576,000

[1] Includes 1,038,400 pounds of copper from precipitates.
[2] Excludes tungsten ore.
[3] Includes metal recovered from tungsten ore.
[4] Includes 2,055,200 pounds of copper from precipitates.

METALLURGIC INDUSTRY

Of the 5,987,013 tons of lode material (including 48,212 tons of old tailings) from Nevada mines sold or treated during 1949, 99 percent went to mills and 1 percent to smelters. In addition to companies that operated metallurgical plants exclusively for their ores, the Combined Metals Reduction Co. at Pioche, Lincoln County, treated by selective flotation zinc and zinc-lead ores on a custom basis for several neighboring mines and also milled company zinc-lead ores. The Kennecott Copper Corp. treated all the copper ore produced by Consolidated Coppermines Corp. on a contract basis, in addition to milling its own ore at the McGill concentrator. Kennecott also operated the McGill copper smelter, Nevada's only smelter, treating—in addition to copper ore and copper concentrate—siliceous gold and silver ores used for fluxing. The Dayton Consolidated Mining Co. beneficiated ore and tailings from mines in seven Nevada counties at the company flotation-cyanide mill in the Comstock district, Storey County, and Double King Mines, Inc. (W. F. Donovan), accepted ore on a custom basis at its cyanide mill in the Silver City district, Lyon County, during 1949.

Mine production of metals in Nevada in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Amalgamation	2,960	1,686			
Cyanidation	62,917	433,625	----------	----------	----------
Concentrates smelted	52,770	956,089	73,654,700	15,979,800	38,859,500
Ore and old tailings smelted	3,810	407,133	1,422,900	5,272,200	2,026,500
Precipitates smelted	----------	----------	1,038,400	----------	----------
Placers	7,942	1,676	----------	----------	----------
Total: 1949	130,399	1,800,209	76,116,000	21,252,000	40,886,000
1948	111,532	1,790,020	90,484,000	19,554,000	40,576,000

Mine production of metals from mills in Nevada in 1949, by counties and classes of concentrates smelted, in terms of recoverable metals

	Material treated		Recoverable in bullion		Concentrates smelted and recoverable metal [1]					
	Ore (short tons)	Old-tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES										
Churchill	18,558	------	3,719	176,901	3	7	1,043	----------	1,500	----------
Clark	2,146	16,076	580	2,231	184	413	3,933	100	157,600	8,800
Elko	698	------	70	58	43	4	789	1,100	28,400	11,200
Esmeralda	19,576	------	15	1,767	937	7,904	2,163	1,900	----------	----------
Eureka	29	------	------	------	9	------	16	----------	3,100	5,000
Humboldt	213,084	------	21,394	3,251	1	------	16	----------	100	----------
Lander	225,491	------	16,687	1,339	4,631	1,055	185,053	108,400	2,575,500	959,100
Lincoln	258,522	------	------	------	53,397	5,343	623,553	441,600	13,124,500	37,794,100
Lyon	3,803	59	953	3,052	------	------	------	----------	----------	----------
Mineral	1,578	115	791	5,122	26	367	2,388	----------	5,200	----------
Nye	2,118	70	578	649	30	124	261	100	----------	----------
Pershing	50,552	------	2,241	8,077	175	34	4,652	3,200	35,200	69,500
Storey	211,620	31,612	18,498	232,725	11	39	970	----------	400	----------
Washoe	425	------	308	110	------	------	------	----------	----------	----------
White Pine	4,847,991	------	43	29	147,031	37,480	131,252	73,098,300	48,300	11,800
Total: 1949	5,856,191	47,932	65,877	435,311	206,478	52,770	956,089	73,654,700	15,979,800	38,859,500
1948	7,055,756	13,257	53,849	387,174	213,789	43,948	701,109	86,482,300	12,271,000	38,286,900
BY CLASSES OF CONCENTRATES										
Dry gold					1,049	8,852	5,501	2,900	400	----------
Dry gold-silver					16	49	1,139	100	400	----------
Dry silver					65	------	1,188	200	1,400	2,900
Copper					146,957	37,477	130,744	73,098,300	----------	----------
Lead					18,612	4,077	464,387	84,200	12,182,800	2,230,700
Zinc					35,214	1,312	168,301	361,600	1,219,600	35,666,800
Zinc-lead					4,565	1,003	184,829	107,400	2,575,200	959,100
Total 1949					206,478	52,770	956,089	73,654,700	15,979,800	38,859,500

[1] Includes concentrates and silver, copper, lead, and zinc from tungsten ore not included with material treated.

Gross metal content of concentrates produced from ores mined in Nevada in 1949, by classes of concentrates

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	1,049	8,852	5,501	3,059	776	
Dry gold-silver	16	49	1,139	199	454	
Dry silver	65		1,188	348	1,632	4,722
Copper	146,957	38,247	141,833	74,663,293		
Lead	18,612	4,077	464,387	99,499	12,399,231	3,083,132
Zinc	35,214	1,312	168,301	380,786	1,325,887	36,399,739
Zinc-lead	4,565	1,003	184,829	126,372	2,621,040	1,325,380
Total: 1949	206,478	53,540	967,178	75,273,556	16,349,020	40,812,973
1948	213,789	43,948	701,109	87,596,104	12,562,261	39,510,152

Gross metal content of Nevada crude ore and old tailings shipped to smelters in 1949, by classes of material

Class of material	Material treated		Gross metal content				
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	2,980	4	1,572	5,817	12,422	1,846	28
Dry gold-silver	1,242	44	394	17,064	1,741	6,996	1,697
Dry silver	6,124	182	204	117,890	5,988	43,264	813
Copper	50,062		671	3,166	[1] 2,182,584	11,734	
Lead	17,483	50	962	250,200	334,659	4,389,895	889,379
Lead-copper	103		2	1,266	6,134	50,698	
Zinc	909			42		41,158	526,385
Zinc-lead	3,644		40	19,849	17,829	916,751	1,297,864
Zinc-lead-copper	63		1	1,099	5,392	31,756	13,500
Total: 1949	82,616	280	3,846	416,393	[1] 2,566,749	5,494,098	2,729,666
1948	102,204	1,394	5,557	700,274	[2] 4,157,595	7,658,496	3,153,209

[1] Includes 1,060,572 pounds of copper from precipitates.
[2] Includes 2,679,218 pounds of copper from precipitates.

Mine production of metals from Nevada crude ore and old tailings shipped to smelters in 1949, in terms of recoverable metals

	Material treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
BY COUNTIES							
Churchill	4		1	2,048		700	
Clark	3,613		56	17,899	13,900	1,007,700	886,000
Elko	4,228		146	66,715	53,300	1,156,800	46,600
Esmeralda	1,407		99	28,355	1,500	129,900	
Eureka	1,116	44	68	14,578	2,100	135,400	226,700
Humboldt	115		26	1,600	7,400	1,400	
Lander	1,169		444	8,618	24,700	9,000	1,000
Lincoln	11,743		510	189,081	334,900	1,006,200	500,600
Lyon	89	1	9	28	15,400		
Mineral	1,381		373	18,617	4,100	199,000	
Nye	1,196	182	349	19,560	3,500	137,600	1,900
Ormsby	16		12	533	200	12,900	
Pershing	57	52	83	1,689		20,200	300
Storey		1	3	10			
Washoe	2			17		700	
White Pine	56,474		1,631	37,785	[1] 2,000,300	1,454,700	363,400
Total: 1949	82,610	280	3,810	407,133	[1] 2,461,300	5,272,200	2,026,500
1948	102,204	1,394	5,557	700,274	[2] 4,001,700	7,283,000	2,289,100
BY CLASSES OF MATERIAL							
Dry gold	2,980	4	1,559	5,507	12,100		
Dry gold-silver	1,242	44	389	16,017	1,600	4,200	
Dry silver	6,124	182	199	109,987	5,100	30,400	300
Copper	50,062		658	3,166	[1] 2,137,200	7,000	
Lead	17,483	50	962	250,200	280,800	4,218,800	637,900
Lead-copper	103		2	1,266	4,900	48,600	
Zinc	909			42		31,300	438,700
Zinc-lead	3,644		40	19,849	15,000	900,700	938,800
Zinc-lead-copper	63		1	1,099	4,600	31,200	9,800
Total 1949	82,610	280	3,810	407,133	[1] 2,461,300	5,272,200	2,026,500

[1] Includes 1,038,400 pounds of copper from precipitates.
[2] Includes 2,055,200 pounds of copper from precipitates.

REVIEW BY COUNTIES AND DISTRICTS

CHURCHILL COUNTY

Holy Cross District.—Clarke C. Shaw worked the Camp Terrell mine throughout 1949; 125 tons of mine and dump ore milled yielded 3 tons of lead concentrate containing 7 ounces of gold, 1,043 ounces of silver, and 1,528 pounds of lead.

Sand Springs District.—Summit King Mines, Ltd. (third largest producer of silver in Nevada in 1949), operated the Summit King group the entire year; 3,637 ounces of gold and 174,718 ounces of silver were recovered from 18,208 tons of gold-silver ore cyanided at the company 60-ton mill.

CLARK COUNTY

Searchlight District.—The Desert Milling Co. recovered 576 ounces of gold and 2,224 ounces of silver from 16,076 tons of Quartette mine tailings by cyanidation at the company 100-ton mill during 1949.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1949, by counties and districts, in terms of recoverable metals [1]

County and district [1]	Mines producing [3]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (lode and placer,[3] fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Churchill County:											
Eastgate	1		135	71		71	426				$2,871
Fairview	1		67	10		10	828				1,099
Holy Cross	3		144	8		8	3,644		2,200		3,926
Sand Springs	1	1	18,208	3,637	10	3,647	174,718				285,774
Wonder	1		8	1		1	376				375
Clark County:											
Searchlight	8		16,399	1,007		1,007	4,109	700	4,500		39,813
Yellow Pine	18		5,436	42		42	19,954	13,300	1,160,800	894,800	316,510
Elko County:											
Delano	2		2,961	16		16	61,026	12,100	943,000		207,170
Ferguson Spring	2		62	1		1	48	5,100			1,083
Gold Circle	2		11	4		4	6				145
Jarbidge	2		484	70		70	70				2,513
Lynn [4]	1		104	70		70	27	200			2,513
Merrimac	1		17				57	3,700	100		797
Mountain City (Cope) (VanDuzer)	2	2	155	54	121	175	1,762	25,100	1,600		12,917
Mud Springs	1		8				63		5,300		894
Railroad	1		140	1		1	1,435	3,100	18,900	19,400	7,337
Ruby Range	4		331	2		2	918	1,900	77,000	11,700	14,892
Spruce Mountain	4		347	1		1	1,359	3,000	61,600	25,500	14,751
Tecoma	1		165	1		1	605	200	42,800		7,384
White Horse	1		8				85		3,500	600	704
Esmeralda County:											
Divide	2		388	35		35	9,110				9,470
Gilbert	1		3	5		5	2				177
Goldfield	(5)	1	(5)	(5)	4	4	(5)	(5)	(5)	(5)	[6] 140
Klondyke	3		47	2		2	382		2,100		748
Lida	2	1	47	25	47	72	934				3,365
Lone Mountain	2		129	1		1	603	500	10,300		2,306
Montezuma	1		124	7		7	5,913	800	78,300		18,126
Palmetto	1		50				364	100	29,000		4,931
Silver Peak	2		703	35		35	11,777	100	10,200		13,516
Sylvania		1			3	3	1				106
Tokop	1		59	4		4	1,057				1,096

Eureka County:											
Cortez	2		234	20		20	10,534	1,000	15,400		12,864
Diamond	2		322	3		3	2,802	1,100	83,100	9,800	17,203
Eureka	6		604	45		45	1,242		36,900	216,900	35,425
Lynn [4]		1			38	38	3				1,333
Roberts	1		29				16		3,100	5,000	1,124
Humboldt County:											
Awakening	5		57,557	1,871		1,871	1,225				66,594
Dutch Flat		1			71	71	9				2,493
Gold Run	1	2	Clean-up		103	103	34		100		3,651
Jackson Creek	1		16	1		1	28	1,100			277
Paradise Valley	1		11	5		5	1				176
Sawtooth		1			2	2					70
Shon	1		16	9		9	520		500		865
Ten Mile	2		50	50		50	34				1,781
Warm Springs	2		83	16		16	1,052	6,300	900		2,895
Lander County:											
Battle Mountain	7	(6)	73,832	1,368	(6)	1,368	187,627	131,500	2,579,400	959,100	[7] 770,071
Bullion	5		152,477	16,791		16,791	1,519	700	300		589,245
Hilltop	2		108	14		14	1,021	200	1,700		1,722
Jersey	1		5				141	200	2,000	1,000	607
Kingston	1		20	8		8	6				285
Lewis	1		47				2,492	400	700		2,445
New Pass	1		Clean-up	3		3					105
Reese River	3		171	2		2	2,204	100	400		2,148
Lincoln County:											
Comet	2		4,982	104		104	17,226	9,000	99,100	497,900	98,401
Eagle Valley	1		12	1		1	634				609
Ferguson	1		131	151		151	104	100			5,399
Groom	1		1,690				1,205		175,600		28,836
Jack Rabbit	2		5,119	58		58	84,232	328,600	594,100	451,900	292,902
Pahranagat	2		7				136		500	100	214
Patterson	1		41				401				363
Pioche	13		258,251	5,537		5,537	708,216	437,300	13,260,700	37,301,600	7,641,503
Tem Piute	1		Tungsten ore				170	300	400	43,200	5,633
Viola	1		32	2		2	310	1,200	300		634
Lyon County:											
Cambridge	1		Clean-up				1				1
Palmyra	4		211	69		69	730				3,076
Silver City	18		3,443	844		844	1,761				31,134
Talapoosa	2		209	48		48	568				2,194
Yerington	2		89	1		1	20	15,400			3,087
Mineral County:											
Acme (Fitting)	1		11	13		13	2				457
Bovard	1		115	43		43	984				2,395
Broken Hills (Quartz Mountain)	1		280				1,084		1,100		1,155
Cedar Mountain	1		38	2		2	391	100	7,700		1,661
Hawthorne	2	1	11	13	8	21	84		400		874
Rawhide (Regent)	6	1	691	33	4	37	1,786		4,100		3,560
Santa Fe	2		137	19		19	443	3,600			1,775
Silver Star	6		82	43		43	697		2,700		2,563

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1949, by counties and districts, in terms of recoverable metals [1]—Con.

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (lode and placer, [3] fine ounces)	Copper (pounds)	Lead (pounds	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Nye County:											
Belmont	1		113	27		27	2,381				$3,082
Bruner	1		9	9		9	70				378
Bullfrog	5		669	240		240	1,597		1,400		10,066
Cloverdale	3	1	94	5	1	6	446				614
Currant	1		7	4		4	7	100			166
Gold Crater	1		4	1		1	75		2,800		545
Hannapah	1		5				11				10
Jett	1		3				85		1,100		251
Johnnie		2			26	26	8				913
Manhattan	5	6	335	263	768	1,031	389				36,436
Quartz Mountain	1		374	33		33	4,829	1,100	77,700		18,018
Reveille	1		210	2		2	1,411	400	45,100		8,552
San Antone	5		350	9		9	4,373	1,900	5,300		5,484
Tonopah	4		91	38		38	3,817				4,785
Troy	2		1,219	408		408	245				14,502
Tybo (Keystone)	1		19				140				127
Washington	2		12	1		1	374		4,200	1,900	1,273
Ormsby County: Delaware	1		16	12		12	533	200	12,900		2,979
Pershing County:											
Antelope	2	(5)	224	1	6	7	2,663	2,900	22,900	69,800	15,499
Goldbanks		(5)			5	5	1				176
Humboldt (Imlay)		4			277	277	142				9,824
Kennedy	1		396	39		39	2,313	300	15,100		5,903
Rabbit Hole		2			7	7	1				246
Relief (Antelope Springs)	1		50	2		2	207		14,300		2,516
Rochester	1	4	53	12	2,062	2,074	587				73,121
Rye Patch (Echo)	2		49,765	2,196		2,196	8,464				84,520
Seven Troughs	3		45	56		56	62				2,016
Staggs	1		26	28		28	447		2,700		1,812
Unionville	1		2	8		8	256		400		575
Storey County: Comstock	14		243,233	18,540		18,540	233,705		400		860,478
Washoe County:											
Galena	1		2				17		700		126
Olinghouse	(5)	1	(5)	(5)	4	4	2				[6] 142
White Pine County:											
Aurum	3		872	10		10	2,248	7,900	286,500	49,700	55,371
Black Horse	2		19	1		1	510		900		639
Cherry Creek	6		125	23		23	558		2,500		1,705
Granite (Steptoe)	3		53	7		7	112		62,000	100	10,154
Mount Washington	1		8				54		2,900		507
Newark	2		35	1		1	597	100	5,300	6,400	2,225
Osceola	4	2	1,041	304	48	352	1,622	200	86,700	11,800	28,989

Robinson	30	----------	4,900,678	38,703	----------	38,703	145,005	75,065,400	423,200	237,200	16,370,005
Taylor	1	----------	13	2	----------	2	1,134	----------	----------	----------	1,096
Tungstonia (Eagle)	4	----------	144	83	----------	83	449	200	9,300	1,400	4,993
Ward	1	----------	17	----------	----------	----------	134	200	4,200	----------	824
White Cloud	1	----------	52	----------	----------	----------	105	100	18,000	700	3,046
White Pine (Hamilton)	9	----------	1,408	20	----------	20	16,546	24,500	601,500	67,900	123,959
Other districts [9]	14	2	177,318	29,072	4,327	33,399	26,148	2,400	219,600	600	1,227,875
Total Nevada	332	37	[10] 5,987,013	122,457	7,942	130,399	1,800,209	[11] 76,116,000	21,252,000	40,886,000	29,615,777

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnote 9 and their output included with "Other districts."
[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[3] Source of total silver as follows: 1,798,533 ounces from lode mines and 1,676 ounces from placers.
[4] Lynn district lies in Elko and Eureka Counties.
[5] Included with "Other districts."
[6] Exclusive of lode output which is included with "Other districts."
[7] Exclusive of placer output which is included with "Other districts."
[8] From property not classed as a mine.
[9] Includes following districts: Ruby Valley in Elko County; Goldfield in Esmeralda County; Potosi in Humboldt County; Battle Mountain (placer) in Lander County; Candelaria (Columbus) and Aurora in Mineral County; Union in Nye County; Table Mountain in Pershing County; and Olinghouse in Washoe County.
[10] Excludes tungsten ore.
[11] Includes 1,038,400 pounds contained in precipitates.

Yellow Pine District.—Otto F. Schwartz and Milton T. Schwartz worked the Combination group from February through December 1949; 88 tons of lead ore containing 1 ounce of gold, 140 ounces of silver, 49,019 pounds of lead, and 8,701 pounds of zinc was shipped to a smelter. During 1949 the Anchor Lease shipped to smelters 283 tons of ore and concentrate, mixed, containing, in recoverable metals, 2 ounces of gold, 1,485 ounces of silver, 400 pounds of copper, 220,400 pounds of lead, and 24,700 pounds of zinc. R. K. Hamilton operated a 75-ton gravity-concentration mill during 1949; ore from the Kirby, Bullion, Root-Zinc, Hoosier, and Ruth properties was treated, and the lead concentrate produced was shipped to a smelter. L. F. Jacobson (Yellow Pine Lease) shipped zinc-lead ore to a smelter from the Yellow Pine, Sultan, and Thomas & Reed mines in 1949; zinc-lead ore from the Prairie Flower mine was treated at a concentrator-smelter.

ELKO COUNTY

Delano District.—Lee H. Bayliss leased the Delno mine from January 1 to November 5, 1949, and shipped 1,356 tons of lead ore containing 6 ounces of gold, 24,734 ounces of silver, 7,073 pounds of copper, and 427,550 pounds of lead to smelters. McFarland & Hullinger shipped lead ore from the Cleveland mine to smelters during 1949.

Lynn District.—Bootstrap Gold Mining Co. developed the Bootstrap mine on Boulder Creek throughout 1949; 104 tons of ore shipped to a smelter contained 70 ounces of gold, 27 ounces of silver, and 209 pounds of copper.

Mountain City (Cope) (Van Duzer) District.—Price D. Montrose and Thos. White shipped 58 tons of ore containing 34 ounces of silver and 24,451 pounds of copper from the Rio Tinto dump to a smelter during 1949. Onstott & Trickey Gold Dredging Co., operating a dragline and trommel on the Estella claim, recovered 118 ounces of gold and 15 ounces of silver from 6,000 cubic yards of gravel treated.

Ruby Range District.—Streeter Lead Co. shipped 16 tons of ore containing 51 ounces of silver, 49 pounds of copper, and 11,346 pounds of lead from the Summit View mine (open cut) to a smelter in 1949.

ESMERALDA COUNTY

Divide District.—Tonopah Divide Mining Co. and lessees shipped 325 tons of ore containing 33 ounces of gold and 8,861 ounces of silver to a smelter and 56 tons of ore containing 2 ounces of gold and 1,125 ounces of silver to a custom cyanide mill from the Tonopah Divide mine in 1949.

Goldfield District.—Goldfield Deep Mines Co. of Nevada operated the Deep Mines group and milled gold ore at the company 100-ton flotation mill throughout 1949. Concentrate shipped to a smelter yielded substantial quantities of gold and silver.

Lida District.—McBoyle, Hain & Bundy worked the Wisconsin group from March 1 to November 1, 1949; 14 tons of ore cyanided at a custom mill yielded 3 ounces of gold and 185 ounces of silver, and 13 tons of ore shipped to a smelter yielded 21 ounces of gold and 729 ounces of silver. A. A. Goehring and associates recovered 40 ounces of gold and 17 ounces of silver from 3,400 cubic yards of gravel at

the Tule Summit mine in 1949; the material was moved mechanically to a sluice box.

Silver Peak District.—Nivloc Mines, Inc., and lessees shipped 687 tons of ore containing 34 ounces of gold and 11,738 ounces of silver to a smelter from the Nivloc mine during 1949.

Tokop District.—W. H. Brown worked the Visuanqua (Shields) mine from May to December 1949; 43 tons of ore containing 3 ounces of gold and 792 ounces of silver were cyanided at a custom mill, and 16 tons of ore containing 2 ounces of gold and 455 ounces of silver were shipped to a smelter.

EUREKA COUNTY

Eureka District.—Silver Rock Mines Co., R. A. Glenny, lessee, shipped 21 tons of ore containing 1 ounce of gold and 481 ounces of silver to a smelter from the Silver Rock mine during 3 months of 1949. Lone Mountain Lease (Charles A. Vaccarro) shipped zinc ore (501 tons containing 42 ounces of silver, 28,500 pounds of lead, and 216,900 pounds of zinc) from the Mountain View group of claims to a smelter in 1949.

HUMBOLDT COUNTY

Awakening District.—Red Ledge Mining Co. and its successor, Austin Jumbo Mines, Inc., operating the Austin (Jumbo) open-pit mine during 1949, recovered 1,692 ounces of gold and 1,169 ounces of silver by amalgamation from approximately 57,000 tons of ore treated at the company 500-ton mill.

Potosi District.—Getchell Mine, Inc., (second-largest producer of gold in Nevada in 1949), operated its rehabilitated 1,500-ton flotation-cyanide mill and the Getchell mine throughout 1949; in addition, the Pinson-Ogee lease was worked from January to April 1949.

Warm Springs District.—T. C. Hapgood operated the Silver Cloud mine near Dyke Canyon from May 20 to August 20, 1949, and shipped 41 tons of ore containing 16 ounces of gold, 913 ounces of silver, 109 pounds of copper, 1,461 pounds of lead, and 1,217 pounds of zinc to a smelter.

LANDER COUNTY

Battle Mountain District.—Copper Canyon Mining Co. worked the Copper Canyon mine and 350-ton flotation mill throughout 1949; 72,132 tons of ore treated yielded 4,565 tons of bulk concentrate (containing 1,003 ounces of gold, 184,829 ounces of silver, 126,372 pounds of copper, 2,621,040 pounds of lead, and 1,325,380 pounds of zinc) which was shipped to a smelter. In addition, lessees worked the company Copper King, Carrissa, and Sweet Marie claims in Copper Basin and shipped gold and copper ores to smelters. The Natomas Co. operated its Natomas-type electric bucket-line dredge (120 $9\frac{1}{2}$-cubic-foot buckets) at Greenan Placers from August 30 to December 31, 1949, recovering a substantial quantity of gold and some silver. Dragline dredging operations at this property ceased September 28, 1948.

Bullion District.—The London Extension Mining Co. (third-largest producer of gold in Nevada) worked the Goldacres open-pit mine throughout 1949, recovering gold and silver by cyanidation at its 350-ton plant.

Hilltop District.—Paul C. Christopher worked the Paymaster mine from May 1 to October 1, 1949, and shipped 48 tons of ore (containing 9 ounces of gold, 1,018 ounces of silver, 202 pounds of copper, 2,874 pounds of lead, and 480 pounds of zinc) to a smelter.

LINCOLN COUNTY

Comet District.—Comet Mines, Inc., operated the Comet mine throughout 1949 and trucked zinc ore to the Combined Metals Reduction Co. Castleton mill for concentration. Silver ore was shipped for direct smelting. Data on a zinc-lead deposit were published.[5]

Eagle Valley District.—Lytle, Jones & Jones worked the Silver Star mine during June and July 1949; 12 tons of ore trucked to a smelter yielded 1 ounce of gold and 634 ounces of silver.

Groom District.—Dan Sheahan operated the Groom mine and 50-ton gravity and flotation mill from January through November 1949; 1,640 tons of ore treated yielded 116 tons of concentrate containing 940 ounces of silver and 152,646 pounds of lead. The concentrate and 50 tons of ore containing 265 ounces of silver and 30,303 pounds of lead were shipped to a smelter.

Jack Rabbit District.—Bristol Silver Mines Co. worked the Bristol mine throughout 1949 and shipped lead and copper ores, each containing gold, silver, copper, lead, and zinc, to smelters.

Pioche District.—The Combined Metals Reduction Co. in 1949 milled 9 percent more company ore but 40 percent less custom ore than in 1948. Company zinc-lead ore was derived from the Abe Lincoln group, the Pioche 802 Division, and the Pioche, Wenlock Free, and Pan American (Comet district) leases. Custom zinc and zinc-lead ores came principally from the Ely Valley Mines, Inc., Ely Valley mine (second-largest producer of zinc in Nevada in 1949), the Prince Consolidated Mining Co. Prince mine, and Raymond Ely West Mining Co. The mill products were lead and zinc concentrates, which were shipped to smelters. In addition, the Prince Mining Co. shipped lead and silver ore for direct smelting; its operation closed down July 19, 1949. Ely Valley Mines, Inc., and lessees worked the Mendha mine throughout 1949, shipping lead ore to a smelter. The Salt Lake Pioche Mining Co. shipped lead ore from the Apex and Financier mines to smelters during 1949.

LYON COUNTY

Silver City District.—Double King Mines, Inc. (W. M. Donovan), operated the Donovan cyanide mill at Silver City in 1949, principally on ore from the company Silver Hill mine (Storey County). Small lots of ore from neighboring mines were milled on a custom basis. The Dayton Consolidated Mines Co. and lessees worked the Dayton and Oest mines during 1949. Other mines active in 1949 included the Buckeye, Triangle, Milwaukee, Montezuma, Research No. 1, Spring Valley, and Three Brothers.

[5] Trengove, Russell R., Investigation of Comet Coalition Lead-Zinc Deposit, Lincoln County, Nev.: Bureau of Mines Rept. of Investigations 4541, 1949, 6 pp.

MINERAL COUNTY

Aurora District.—Chessher & Co. operated the Chesco mine and mill during 1949. Most of the gold concentrate produced was cyanided at the Central Comstock Mines Co. mill in Storey County; small lots were shipped direct to a smelter.

Candelaria (Columbus) District.—G. A. Peterson worked the New Potosi, Mount Ridge, and Mount Potosi claims throughout 1949 and shipped lead ore containing some gold, silver, and copper to smelters.

Rawhide (Regent) District.—Rawhide Queen Mining Co. operated the Rawhide Queen mine from October 1 to November 15, 1949. Approximately 545 tons of ore cyanided at the company 50-ton mill yielded 23 ounces of gold and 283 ounces of silver.

NYE COUNTY

Bullfrog District.—Homer Weeks and associates operated the Senator Stewart mine in 1949; gold and silver was recovered from the gold ore by amalgamation and cyanidation at custom mills and from concentrate shipped to a smelter.

Cloverdale District.—Dunsdon & Cornell worked the Nevada group (Republic) from June 15 to November 1, 1949; 12 tons of ore containing a trace of gold and 467 ounces of silver were shipped to a smelter.

Jett District.—Valley Silver & Lead Co. operated the Valley Silver-Lead mine from June 1 to August 31, 1949; 2½ tons of ore shipped to a smelter contained 85 ounces of silver, 14 pounds of copper, and 1,170 pounds of lead.

Manhattan District.—Louis Cereghino, lessee, shipped 71 tons of ore containing 43 ounces of gold and 26 ounces of silver to a smelter in 1949. Albert White and George Rong recovered 12 ounces of gold and 6 ounces of silver by amalgamating 45 tons of gold ore at the Orphant mine from January to June 1949. Fehn, Johnson & Pittser recovered 687 ounces of gold and 241 ounces of silver in 1949 from gravel in Manhattan Gulch, using a power shovel, trommel, and jigs.

Quartz Mountain District.—Obie LeFavor shipped lead ore to a smelter from the San Rafael mine during 1949.

San Antone District.—Hubert Welch shipped 33 tons of ore containing 3 ounces of gold and 374 ounces of silver from the Cloverdale mine and 44 tons of ore containing 1 ounce of gold and 495 ounces of silver from the Green Metals mine to a smelter in 1949.

Troy District.—Old English Gold Corp. worked the Old English mine from January 1 to August 18, 1949; 1,215 tons of ore amalgamated yielded 328 ounces of gold and 48 ounces of silver and 24 tons of concentrate shipped to a smelter contained 80 ounces of gold and 77 ounces of silver.

PERSHING COUNTY

Humboldt District.—Wallace Calder recovered 32 ounces of gold and 16 ounces of silver from 600 cubic yards of gravel at the Wadley mine during 3 months of 1949, operating a dragline, bulldozer, and trommel.

Rochester District.—The Southwest Dredging Co. (second-largest producer of placer gold in Nevada in 1949) worked its excavating

equipment and dry-land washing plant at Spring Valley Placers during 1949.

Rye Patch (Echo) District.—The Standard Cyaniding Co. treated ore from its Standard (Lally) open-pit mine by cyanidation until May 1949, when the property was closed down.

STOREY COUNTY

Comstock District.—Central Comstock Mines Corp. treated Central Comstock tailings by cyanidation from August 1 to December 31, 1949, recovering substantial quantities of gold and silver. Consolidated Chollar, Gould & Savage Mining Co. operated the Overman open-pit mine throughout 1949 and recovered 9,665 ounces of gold and 147,240 ounces of silver from 167,423 tons of ore treated at the company 500-ton cyanide mill. Dayton Consolidated Mines Co. operated its cyanide plant on custom ores from various mining districts in Nevada and California in addition to treating ore from the company Keystone, Justice, and Woodville mines and the Dayton and Oest mines in Lyon County. Double King Mines, Inc. (W. M. Donovan), worked the Silver Hill open-pit mine during 1949 and treated the ore by cyanidation in the company mill at Silver City.

WASHOE COUNTY

Galena District.—Benjamin J. Constant operated the Galena Hill mine during August 1949 and shipped 2 tons of ore containing 17 ounces of silver, 7 pounds of copper, and 744 pounds of lead to a smelter. Data on a zinc-lead mine were published.[6]

WHITE PINE COUNTY

Aurum District.—The Grand Deposit Mining Co. worked the Grand Deposit mine throughout 1949 and shipped 756 tons of ore containing 9 ounces of gold, 1,844 ounces of silver, 7,251 pounds of copper, 239,123 pounds of lead, and 68,168 pounds of zinc to a smelter. Sound State Metals, Inc., operated the Sound State mine from June 15 to October 14, 1949; 108 tons of ore containing 1 ounce of gold, 160 ounces of silver, 2,011 pounds of copper, and 49,133 pounds of lead were shipped to smelters.

Black Horse District.—H. B. Hersey & Anna Lee Tilford shipped 16 tons of ore containing 1 ounce of gold and 532 ounces of silver to a smelter from the Anna Lee mine in 1949.

Mount Washington District.—Hulse & Cottino operated the St. Lawrence mine from July 9 to October 9, 1949; 8 tons of ore trucked to a smelter contained 54 ounces of silver, 10 pounds of copper, and 3,028 pounds of lead.

Osceola District.—The Kenison-Alverson Lease shipped 355 tons of ore with a gross metal content of 5 ounces of gold, 696 ounces of silver, 59,050 pounds of lead, and 14,070 pounds of zinc to a custom mill for concentration.

Robinson District.—The Kennecott Copper Corp. (Nevada Mines Division) operated the Pit mine jointly with the Consolidated Copper-

[6] Geehan, Robert W., Investigation of the Union Zinc-Lead Mine, Washoe County, Nev.: Bureau of Mines Rept. of Investigations 4623, 1950, 10 pp.

mines Corp. throughout 1949. The ore from this mine and the copper ore produced by the Consolidated Coppermines Corp. was treated at Kennecott's McGill 18,000-ton flotation concentrator and copper smelter. The Consolidated Coppermines Corp. closed its underground copper mines June 30, 1949, but substantial quantities of lead ore and zinc ore were shipped to smelters from 12 claims by lessees throughout 1949.

Ward District.—The O. B. Mining Co. worked the Pleadis-Good Luck mine from July to October 1949 and shipped 17 tons of ore containing 134 ounces of silver, 300 pounds of copper, 4,345 pounds of lead, and 880 pounds of zinc to a smelter.

White Cloud District.—C. F. Crafts & Lowell Peterson operated the Lead King mine from May 1 to December 31, 1949; 52 tons of ore containing 105 ounces of silver, 182 pounds of copper, 18,302 pounds of lead, and 982 pounds of zinc were shipped to a smelter.

White Pine District.—Kidder & King, lessees, and Hamilton Leasing Co., sublessees, worked the Onetha claim from March 1 to December 31, 1949; 542 tons of ore containing 4 ounces of gold, 3,703 ounces of silver, 14,660 pounds of copper, 264,262 pounds of lead, and 68,181 pounds of zinc were shipped to a smelter.

New Mexico

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. Martin

GENERAL SUMMARY

THE OUTPUT of copper, lead, and zinc decreased heavily in New Mexico in 1949. The 49-percent decline in the price of zinc from March to June, with high production costs continuing, led to the closing by July 15 of all but one of the State's seven major zinc-producing mines and most of the small-scale operations. The output of recoverable zinc in the latter half of the year was only 5,749 tons compared with 23,597 tons in the first half; the total for the year decreased 29 percent from 1948 and was the lowest since 1938. The production of lead, the bulk of which comes from mines yielding chiefly zinc, decreased 39 percent. Copper output decreased 26 percent, although the monthly production rate was fairly steady throughout the year despite a sharp decline in the price of copper. The large Chino open-pit mine in Grant County and the Bonney-Miser's Chest and Atwood mines in Hidalgo County operated continuously. The copper-leaching operation at the Burro Mountain mine in Grant County shut down April 30. Nearly all the gold and silver production was derived from base-metal ores; the total quantity of gold recovered decreased 5 percent, and silver 29 percent from 1948. The total value of the output of the five metals decreased from $46,799,576 in 1948 to $31,029,120 in 1949.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

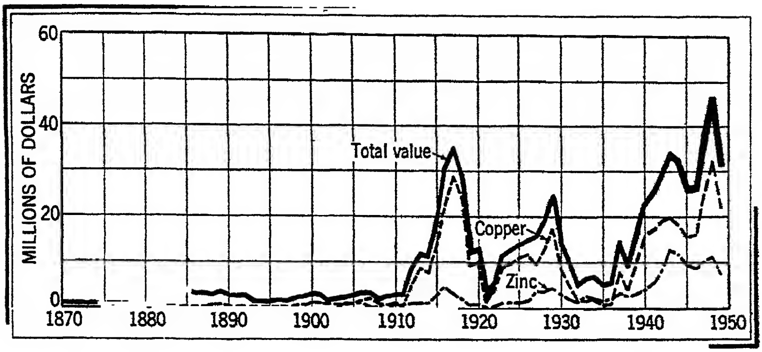

FIGURE 1.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1870–1949. The value of gold, silver, and lead produced annually has been relatively small.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	267	34,100	4,658	487	3,230
February	264	34,800	4,620	610	3,730
March	356	48,450	5,220	858	4,315
April	324	38,420	4,100	599	4,182
May	285	39,580	5,020	764	4,290
June	394	41,360	5,430	612	3,850
July	268	27,250	5,500	296	1,530
August	229	25,280	4,130	183	890
September	199	21,061	3,550	84	856
October	176	18,254	3,720	45	862
November	253	26,400	4,390	59	800
December	234	25,900	5,050	55	811
Total: 1949	3,249	380,855	55,388	4,652	29,346
1948	3,414	537,674	74,687	7,653	41,502

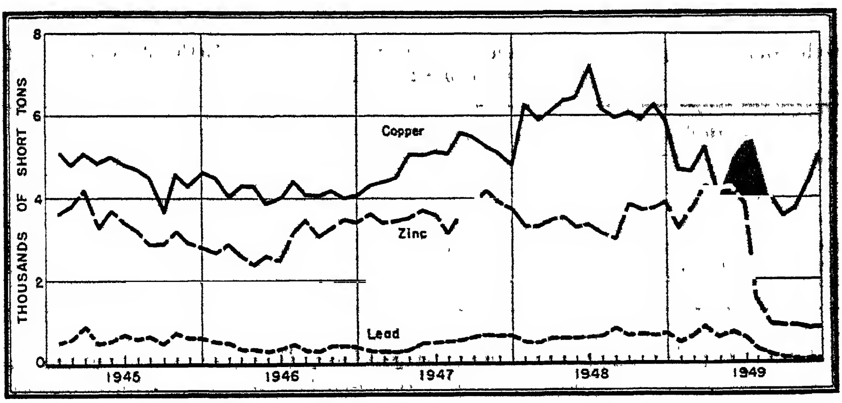

FIGURE 2.—Mine production of copper, lead, and zinc in New Mexico, by months, 1945–49, in terms of recoverable metals.

The following table shows the number of mines in New Mexico producing gold, silver, copper, lead, and zinc and their annual output of ore and metals from 1945 to 1949, as well as the total production from 1848 to 1949. The report of this series for 1929 (chapter of Mineral Resources of the United States, 1929, pt. 1, pp. 729–759) gives the yearly production of each important metal-producing district in New Mexico from 1904 to 1929, inclusive. Subsequent records, year by year, may be found in annual issues of Mineral Resources and Minerals Yearbook.

Mine production of gold, silver, copper, lead, and zinc in New Mexico, 1945–49, and total, 1848–1949, in terms of recoverable metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	46	4	6,843,327	5,604	$196,140	465,127	$330,757
1946	50	4	6,594,890	4,009	140,315	338,000	273,104
1947	82	3	7,352,945	3,146	110,110	515,833	466,829
1948	91	2	7,733,163	3,414	119,490	537,674	486,622
1949	77	3	6,539,602	3,249	113,715	380,855	344,693
1848–1949			(1)	2,192,644	50,076,733	69,189,093	54,243,342

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	56,571	$15,274,170	7,662	$1,317,864	40,295	$9,267,850	$26,386,781
1946	50,191	16,261,884	4,899	1,067,982	36,103	8,809,132	26,552,417
1947	60,205	25,286,100	6,383	1,838,304	44,103	10,672,926	38,374,269
1948	74,687	32,414,158	7,653	2,739,774	41,502	11,039,532	46,799,576
1949	55,388	21,822,872	4,652	1,470,032	29,346	7,277,808	31,029,120
1848–1949	1,540,479	477,951,847	293,529	34,604,009	959,891	155,018,458	771,894,389

[1] Figures not available.

Gold and silver produced at placer mines in New Mexico, 1945–49, in terms of recoverable metals

Year	Gold		Silver		Total value	Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value			Fine ounces	Value	Fine ounces	Value	
1945	15	$525	7	$5	$530	1948	9	$315	2	$2	$317
1946	10	350	2	2	352	1949	31	1,085	9	8	1,093
1947	23	805	10	9	814						

Gold.—Of the 3,249 fine ounces of gold produced in New Mexico in 1949, copper ore yielded 71 percent, zinc ore 17 percent, gold and silver ores and placer gravel 9 percent, and lead and zinc-lead ores 3 percent. The Atwood copper mine in Hidalgo County was again the only producer of more than 1,000 ounces of gold in the State.

Silver.—Some silver ore was shipped from scattered mines, prospects, and dumps in New Mexico in 1949, but most of the silver output

(380,855 fine ounces) was recovered from base-metal ores. Zinc and zinc-lead ores yielded 50 percent and copper ore 41 percent of the State total silver. The principal producers of silver were the Atwood copper mine in Hidalgo County, the Ground Hog zinc-lead mine in Grant County, and the Bonney-Miser's chest (Banner) copper mine in Hidalgo County.

Copper.—The bulk of the New Mexico output of copper in 1949, as in the past, came from the Chino open-pit mine of the Kennecott Copper Corp. at Santa Rita, Grant County. Other substantial producers were the Bonney-Miser's chest and Atwood mines in Hidalgo County. The leaching operation of the Phelps Dodge Corp. at its Burro Mountain mine at Tyrone, Grant County, shut down April 30. The State output of recoverable copper was 55,388 short tons compared with 74,687 tons in 1948. Copper ore and precipitates yielded 99 percent of the State total copper in both years.

Lead.—The New Mexico output of lead comes largely from mines yielding chiefly zinc. Lead ore mined in 1949 totaled 7,152 tons and zinc-lead ore 58,590 tons, compared with 12,671 and 124,921 tons, respectively, in 1948. The total output of recoverable lead was 4,652 tons in 1949 and 7,653 tons in 1948. The principal producers of lead in 1949 were the Bayard and Ground Hog groups in the Central district and the Kelly group (including Lynchburg mine) in the Magdalena district.

Zinc.—Successive declines in the price of zinc beginning with a drop from 17.5 to 16 cents a pound March 23 and continuing until a low of 9 cents was reached June 15 caused most of the zinc and zinc-lead mines in New Mexico to shut down. Large producers that suspended operations were the American Smelting & Refining Co. Ground Hog mine, the United States Smelting, Refining & Mining Co. Bayard group, the New Mexico Consolidated Mines Co. Kearney mine, the Kennecott Copper Corp. Oswaldo mine, and the Peru Mining Co. Pewabic mine—all in the Central district, Grant County; and the Waldo mine of the American Smelting & Refining Co. at Magdalena, Socorro County. The first five of the foregoing mines, ranking in the order named, were among the six leading producers of zinc in the State in 1949; the largest producer was the Empire Zinc Co. Hanover mine in the Central district, operated throughout the year. The State output of recoverable zinc in 1949 was 29,346 tons compared with 41,502 tons in 1948. The Central district produced 90 percent, the Magdalena district 8 percent, and other districts 2 percent of the State total zinc in 1949.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1949, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Catron	1	-	28	$980	2,591	$2,345
Dona Ana	4	-	-	-	201	182
Grant	22	2	1,074	37,590	179,262	162,241
Guadalupe	1	-	-	-	3,991	3,612
Hidalgo	19	-	1,987	69,545	156,641	141,768
Lincoln	3	-	40	1,400	21	19
Luna	4	-	-	-	221	200
Otero	1	-	-	-	-	-
Santa Fe	4	1	21	735	938	849
Sierra	10	-	48	1,680	2,738	2,478
Socorro	8	-	51	1,785	34,251	30,999
Total: 1949	77	3	3,249	113,715	380,855	344,693
1948	91	2	3,414	119,490	537,674	486,622

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Catron	-	-	-	-	-	-	$3,325
Dona Ana	14	$5,516	2	$632	20	$4,960	11,290
Grant	53,289	20,995,866	2,894	914,504	27,020	6,700,960	28,811,161
Guadalupe	76	29,944	-	-	-	-	33,556
Hidalgo	1,935	762,390	381	120,396	36	8,928	1,103,027
Lincoln	-	-	1	316	-	-	1,735
Luna	-	-	19	6,004	-	-	6,204
Otero	-	-	5	1,580	-	-	1,580
Santa Fe	8	3,152	19	6,004	7	1,736	12,476
Sierra	1	394	39	12,324	-	-	16,876
Socorro	65	25,610	1,292	408,272	2,263	561,224	1,027,890
Total: 1949	55,388	21,822,872	4,652	1,470,032	29,346	7,277,808	31,029,120
1948	74,687	32,414,158	7,653	2,739,774	41,502	11,039,532	46,799,576

MINING INDUSTRY

The sharp declines in prices of copper, lead, and zinc from March to June 1949, without corresponding reductions in the cost of labor and materials used in producing the metals, led to a large decrease from 1948 in the quantity of ores mined in New Mexico. Six of the seven larger producers of zinc and zinc-lead ores had shut down by July 15, laying off more than 1,000 men. Other zinc and lead mines that closed or curtailed operations laid off about 200 men. The output of combined zinc and zinc-lead ores decreased 27 percent and that of copper ore 14 percent from 1948. The Chino open-pit mine of the Kennecott Copper Corp. at Santa Rita, Grant County, was, as usual, much the largest producer of ore in the State.

Work in the Central district on developing zinc-lead ore bodies at greater depth was suspended at some properties, but that at the Ground Hog mine was continued throughout the year, although the mining of ore ceased July 15. The Bureau of Mines made field examinations and metallurgical tests on ores and did exploratory drilling and channel sampling on the Royal John property in Grant County.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in New Mexico in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold ore	4	290	86	265	748	2,000	3,000
Dry gold-silver ore	4	680	170	5,254	1,790	3,000	
Dry silver ore	8	4,394	7	23,102	1,391	27,832	
Total	16	5,364	263	28,621	3,929	32,832	3,000
Copper ore	9	6,105,174	2,304	155,094	[1] 109,950,057	246,710	
Lead ore	31	7,152	56	7,331	11,342	1,058,957	55,622
Zinc ore	10	363,322	559	140,381	723,804	5,056,881	53,365,787
Zinc-lead ore	11	58,590	36	49,419	86,868	2,908,620	5,267,591
Total	61	6,534,238	2,955	352,225	[1] 110,772,071	9,271,168	58,689,000
Total lode mines	[2] 77	6,539,602	3,218	380,846	[1] 110,776,000	9,304,000	58,692,000
Placers	3		31	9			
Total: 1949	80	6,539,602	3,249	380,855	[1] 110,776,000	9,304,000	58,692,000
1948	93	7,733,163	3,414	537,674	[1] 149,374,000	15,306,000	83,004,000

[1] Copper contained in precipitates recovered from mine water and leached dumps is included with that in copper concentrates as follows: 1949, 30,789,314 pounds of copper; 1948, 38,937,830 pounds of copper.
[2] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

METALLURGIC INDUSTRY

Ten flotation mills in New Mexico treated zinc and lead ores in 1949. Of the five larger mills, two were closed in June and one in July, and all three were idle the rest of the year. Three of the five small mills ran intermittently. The daily capacity of the 10 mills ranged from 35 to 1,000 tons and averaged 314 tons. The American Smelting & Refining Co. gave up its lease on the Combination (Blackhawk) mill at Hanover and began constructing a mill at Deming. Still Bros. remodeled a mill at Lordsburg formerly used for fluorspar and treated lead and zinc ores after August. The two mills treating copper ore (the Chino concentrator at Hurley, Grant County, and the Banner Mining Co. mill near Lordsburg, Hidalgo County), operated throughout 1949.

The Chino smelter of the Kennecott Copper Corp. at Hurley treats concentrates from the Chino mill, siliceous copper ore (used as a flux) from the Chino mine, and copper precipitates from company operations at Chino and at Ray, Ariz. The smelter produces fire-refined copper and some blister copper. Direct-smelting ore and lead and copper concentrates from other New Mexico operations were shipped to smelters in Arizona, Illinois, Kansas, Montana, Pennsylvania, and Texas.

Mine production of metals in New Mexico in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	9	7			
Concentrates smelted	1,621	242,479	[1] 109,091,270	8,670,725	58,691,246
Ore smelted	1,588	138,360	1,684,730	633,275	754
Placer	31	9			
Total: 1949	3,249	380,855	[1] 110,776,000	9,304,000	58,692,000
1948	3,414	537,674	[1] 149,374,000	15,306,000	83,004,000

[1] Copper contained in precipitates recovered from mine water and leached dumps is included with that in copper concentrates as follows: 1949, 30,789,314 pounds of copper; 1948, 38,937,830 pounds of copper.

Mine production of metals from New Mexico ores milled in 1949, in terms of recoverable metals

	Ore treated (short tons)	Recoverable in bullion: Gold (fine ounces)	Recoverable in bullion: Silver (fine ounces)	Concentrates smelted and recoverable metal: Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Dona Ana	213			43			1,000		40,000
Grant	6,337,936			270,355	870	161,595	[1] 105,933,474	5,782,098	54,040,000
Hidalgo	56,856			6,567	721	49,344	3,073,066	489,544	71,246
Santa Fe	587			43	5	433		29,668	14,000
Sierra	100	9	7	9		35		6,600	
Socorro	46,624			7,385	25	31,072	83,730	2,362,815	4,526,000
Total: 1949	6,442,316	9	7	284,402	1,621	242,479	[1] 109,091,270	8,670,725	58,691,246
1948	7,615,219	28	105	329,341	1,718	389,652	[1] 147,334,768	14,591,603	83,004,000
BY CLASSES OF ORE TREATED									
Dry gold	205	9	7	5	28	226	748	2,000	3,000
Dry silver	1,024			93	2	4,114	1,079	27,432	
Copper	6,013,122			211,974	963	43,389	[1] 108,270,536		
Lead	6,057			781	33	4,976	8,285	676,742	55,622
Zinc	363,322			62,850	559	140,381	723,804	5,056,881	53,365,787
Zinc-lead	58,586			8,699	36	49,393	86,818	2,907,670	5,266,837
Total 1949	6,442,316	9	7	284,402	1,621	242,479	[1] 109,091,270	8,670,725	58,691,246

[1] Copper contained in precipitates recovered from mine water and leached dumps is included with that in copper concentrates as follows: 1949, 30,789,314 pounds of copper; 1948, 38,937,830 pounds of copper.

Gross metal content of concentrates produced from ores mined in New Mexico in 1949, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Copper	212,040	5,165	98,978	[1] 113,122,862	3,062	10,000
Lead	7,158	408	136,751	292,711	7,918,056	798,909
Lead-copper	7		3,207	813	3,064	
Dry iron [2]	5,729		1,922	16,427		123,638
Zinc	59,468	266	67,687	648,362	1,273,302	64,877,001
Total: 1949	284,402	5,839	308,545	[1] 114,081,175	9,197,484	65,809,548
1948	329,341	7,487	500,802	[1] 150,318,069	15,462,226	93,059,368

[1] Copper contained in precipitates recovered from mine water and leached dumps is included with that in copper concentrates as follows: 1949, 31,408,905; 1948, 39,698,539 pounds of copper.
[2] From zinc and zinc-lead ores.

Gross metal content of New Mexico crude ore shipped to smelters in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	85	49	32	174	72	
Dry gold-silver	680	170	5,254	2,299	4,978	
Dry silver	3,370	5	18,988	1,723	696	
Copper	92,052	1,341	111,705	1,986,340	412,083	
Lead	1,095	23	2,355	5,135	403,005	658
Zinc-lead	4		26	60	990	958
Total: 1949	97,286	1,588	138,360	1,995,731	821,824	1,616
1948	117,944	1,702	148,823	2,697,801	794,686	

Mine production of metals from New Mexico crude ore shipped to smelters in 1949, by counties, in terms of recoverable metals

County	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Catron	101	28	2,591			
Dona Ana	988		201	27,600	4,000	
Grant	63,423	176	17,658	644,526	5,902	
Guadalupe	5,526		3,991	152,000		
Hidalgo	25,693	1,266	107,297	796,934	272,456	754
Lincoln	91	40	21		2,000	
Luna	69		221		38,000	
Otero	46				10,000	
Santa Fe	106	13	505	16,000	8,332	
Sierra	332	39	2,696	2,000	71,400	
Socorro	911	26	3,179	46,270	221,185	
Total: 1949	97,286	1,588	138,360	1,684,730	633,275	754
1948	117,944	1,659	147,915	2,039,232	714,397	

REVIEW BY COUNTIES AND DISTRICTS

CATRON COUNTY

Mogollon (Cooney) District.—Mathis & Mathis did repair work at the Lehigh Metals Co. Consolidated group from October 14 through December 1949 and shipped to the El Paso smelter 101 tons of old mill tailings and clean-up material containing gold and silver. Mining was begun January 3, 1950.

DONA ANA COUNTY

Organ District.—The Merrimac mine, operated by J. H. Brown part of 1949, shipped 213 tons of ore containing 1,960 pounds of copper and 50,098 pounds of zinc. M. F. Drunzer shipped copper ore from the Torpedo group during October and November. Some lead-silver ore was shipped from the Hilltop-Black Prince group and the New York claim. The Bureau of Mines began work October 1 on a diamond-drilling research project near Organ.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1949, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)		
	Lode	Placer		Lode	Placer	Total
Catron County: Mogollon	1		101	28		28
Dona Ana County: Organ	4		1,201			
Grant County:						
Camp Fleming	1		460			
Central [1]	9		6,379,719	869		869
Eureka	2		12,017	7		7
Lone Mountain	1		2,509	3		3
Pinos Altos	5	2	3,812	66	28	94
Steeple Rock	2		347	101		101
Swartz	2		2,495			
Guadalupe County: Pintado	1		5,526			
Hidalgo County:						
[illegible]	4		470	6		6
Lordsburg	10		81,640	1,981		1,981
San Simon	5		439			
Lincoln County:						
Nogal	2		9			
White Oaks	1		82	40		40
Luna County: Cooks Peak	4		69			
Otero County: Sacramento	1		46			
Santa Fe County:						
Cerrillos	3		643	6		6
San Pedro (New Placers)	1	1	50	12	3	15
Sierra County:						
Chloride	3		237	2		2
Hermosa	1		26			
Kingston	3		53			
Las Animas	2		11	2		2
Pittsburg and Caballos Mountains	1		55	35		35
Tierra Blanca	1		50			
Socorro County:				9		9
Hansonberg	2		2,118	1		1
Magdalena	6		45,417	50		50
Total New Mexico	77	3	6,539,602	3,218	31	3,249

[1] See footnote at end of table.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1949, by counties and districts, in terms of recoverable metals—Continued

County and district	Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer	Total				
Catron County: Mogollon	2,591		2,591				$3,325
Dona Ana County: Organ	201		201	28,000	4,000	40,000	11,290
Grant County:							
Camp Fleming	832		832				753
Central [1]	136,483		136,483	[2] 106,552,000	4,958,000	52,751,000	28,469,171
Eureka	19,493		19,493	6,000	341,000	276,000	107,171
Lone Mountain	13,356		13,356				12,193
Pinos Altos	5,879	9	5,888	15,000	186,000	486,000	101,226
Steeple Rock	1,409		1,409	2,000	3,000	3,000	6,050
Swartz	1,801		1,801	3,000	300,000	524,000	114,597
Guadalupe County: Pintado	3,991		3,991	152,000			33,556
Hidalgo County:							
Eureka	6,402		6,402	1,000	7,000		7,307
Lordsburg	149,312		149,312	3,868,000	683,000	51,000	1,080,704
San Simon	927		927	1,000	72,000	21,000	15,016
Lincoln County:							
Nogal	18		18		2,000		332
White Oaks	3		3				1,403
Luna County: Cooks Peak	221		221		38,000		6,204
Otero County: Sacramento					10,000		1,580
Sante Fe County:							
Cerrillos	757		757		38,000	14,000	8,635
San Pedro (New Placers)	181		181	16,000			3,841
Sierra County:							
Chloride	296		296	1,000	65,000		10,805
Hermosa	729		729		2,000		976
Kingston	1,272		1,272		3,000		1,695
Las Animas	338		338	1,000			1,728
Pittsburg and Caballos Mountains	96		96		8,000		1,351
Tierra Blanca	7		7				321
Socorro County:							
Hansonberg	633		633		261,000		41,846
Magdalena	33,618		33,618	130,000	2,323,000	4,526,000	986,044
Total New Mexico	380,846	9	380,855	[2] 110,776,000	9,304,000	58,692,000	31,029,120

[1] Includes Burro Mountain district gold, silver, and copper, figures for which Bureau of Mines is not at liberty to publish separately.
[2] Includes copper recovered from precipitates.

GRANT COUNTY

Burro Mountain (Tyrone) District.—The copper-leaching operations of the Phelps Dodge Corp. at the Burro Mountain mine, in progress since May 1941, were shut down April 30, 1949. The Malone Darhasana Mining Co. shipped to smelters several hundred tons of gold-silver ore from its mine, operated from January to August. A small lot of lead-silver ore was shipped from the Silver Blade claim.

Camp Fleming District.—C. T. McLendon shipped silver ore from the Old Man dump in 1949.

Central (Bayard, Fierro, Georgetown, Hanover, Santa Rita) District.—The Chino open-pit mine of the Kennecott Copper Corp., Chino Mines Division at Santa Rita, operated continuously in 1949. Rail haulage from the pit was described in a paper by A. P. Morris.[1] The following data were obtained from the paper:

The bottom level of the pit was about 400 feet below the surface on the west side and 650 feet on the east side at the end of 1948. It is anticipated that future operations will extend the depth an additional 250 feet. From 1910 to 1948 about 128,000,000 tons of ore and 180,000,000 tons of waste were removed

[1] Morris, A. P., Rail Haulage at Chino: Min. Eng., October 1949, pp. 44–45.

from the pit by rail haulage; the tonnages for 1948 were 6,700,000 tons of ore and 6,900,000 tons of waste.

In 1949 there were 11 operating benches in the pit. The ore is loaded with electric shovels into standard-gage railroad cars on the benches and hauled out of the pit over the mine railroad to the Atchison, Topeka & Santa Fe Railway branch line west of the pit for delivery to the treatment plants at Hurley, 10 miles from the mine. The concentrator has a daily (maximum) capacity of 22,500 tons. Molybdenite is recovered in the mill as a byproduct. The copper concentrate is smelted in the company smelter adjacent to the mill. The smelter also treats precipitates derived from dump leaching and siliceous copper ore used as a flux. The copper bullion contains minor quantities of gold and silver, which are not recovered from fire-refined copper, the major product of the smelter; the blister copper made contains some recoverable gold and silver. The company operated its Oswaldo zinc mine from January to June 17, shipping the ore to the Empire Zinc Co. mill at Hanover. The total development in the Oswaldo mine at the end of 1949 comprised two vertical shafts 490 and 705 feet deep, 11,247 feet of drifts, and 640 feet of raises.

The Empire Zinc Co. Hanover mine operated continuously and was the largest New Mexico producer of zinc in 1949. The ore was concentrated in the company flotation mill, which also handled custom ore from the Oswaldo, Royal John, and Grand View mines in Grant County and the Kelly group in Socorro County.

In 1949, the American Smelting & Refining Co. operated its Ground Hog zinc-lead mine group and the leased 400-ton Hanover (formerly Combination-Blackhawk) mill from January 1 to July 15. The mill treated company ore from the Ground Hog, Ivanhoe, and Lucky Bill claims and custom ore from the Royal John and Grand View mines. Work on developing the ore deposits in the Ground Hog mine at greater depth continued after mining was suspended. The new four-compartment Star shaft was completed to a depth of 1,926 feet. The new three-compartment No. 5 shaft was sunk to the 1,768-foot level. Drifting during the year totaled 2,583 feet and diamond drilling 7,534 feet.

The Bayard mine of the United States Smelting, Refining & Mining Co., a large producer of zinc-lead-silver ore since March 1943, was closed in June 1949 because of declines in the prices of zinc and lead. The mine is equipped with a 600-ton flotation mill. Until the shut-down the company carried on extensive exploration and development work on the Bayard property, which includes the Bull Frog, Hanover Bessemer, and Shingle Canyon groups.

The Pewabic and Kearney mines, operated respectively by the Peru Mining Co. and its subsidiary, the New Mexico Consolidated Mining Co., were in production from January to June 17; continued operation at that time was not warranted because the price of lead and zinc dropped to a level too low to support the prevailing high production costs. Data on mining methods and costs at the Kearney mine were published during the year.[2]

[2] Storms, Walter R., and Faust, Jerry W., Mining Methods and Costs at the Kearney Zinc-Lead Mine, Central Mining District, Grant County, N. Mex.: Bureau of Mines Inf. Cir. 7507, 1949, 11 pp.

Eureka District (*see also* **Hidalgo County**).—The Hornet mine near Hachita was operated throughout 1949 by Mineral Operations, Inc. The daily production rate was about 40 tons of zinc-lead ore, which was treated in the 100-ton selective-flotation mill at the mine. Some lead-silver ore was shipped from the Kino mine.

Lone Mountain District.—Low-grade silver ore was shipped from the Ben-Hur Mayflower property in 1949.

Pinos Altos District.—The Houston-Thomas mine was operated by Mathis & Mathis in 1949 from January 1 to June 14. The output (shipped to the Peru mill at Deming) totaled 2,844 tons of ore containing 4,609 ounces of silver, 8,576 pounds of copper, 186,646 pounds of lead, and 398,828 pounds of zinc. Other small producers were the Cleveland, Langston, George Schafer, and Uncle John lode properties, and a placer on Bear Creek. Data on mining methods and costs at the Atlas No. 2 mine (idle 1949) were published.[3]

Steeple Rock District.—The Carlisle group was operated in 1949 from January 1 to April 12 by Liberty Mines, Inc. The ore produced was shipped to custom plants in Arizona. The Ontario Mining Co. operated the Ontario mine 8 months and shipped gold-silver ore containing a little lead and copper to the El Paso smelter.

Swartz (Carpenter, Camp Monarch) District.—The Royal John mine was operated by lessees in 1949 and shipped zinc-lead ore to custom mills. The Bureau of Mines carried out a channel sampling and core drilling project on this property during the year. Strong and Harris operated the Grand View mine from January 1 to December 5; the ore produced was shipped to custom mills in the Central district.

GUADALUPE COUNTY

Pintado District.—Drunzer & Casner shipped siliceous copper ore from the Stauber mine to the El Paso smelter in 1949.

HIDALGO COUNTY

Eureka (Sylvanite) District.—Lessees at the Rincon mine shipped several hundred tons of silver-copper ore in 1949. Some ore was shipped from the Last Chance, Lead Queen, and Sylvanite mines.

Lordsburg District.—The Banner Mining Co. Bonney-Miser's Chest group, principal producer of copper in this district since 1936, operated continuously in 1949. Mine development during the year included 10 feet of shaft, 1,386 feet of drifts, 75 feet of raises, and 1,035 feet of diamond drilling. The Bonney property had two vertical shafts 1,500 and 600 feet deep and a 700-foot incline shaft, and the Miser's Chest had a 1,103-foot incline shaft. The ore was treated in the company 500-ton flotation mill, which makes a 97-percent-plus recovery on the copper. C. H. & S. A. McIntosh operated the Atwood copper mine, shipping the ore crude to smelters. The ore yields considerable gold and silver and some lead, in addition to copper. The Lordsburg Mining Co. operated the Millsite mine 6 months and shipped to the Peru mill at Deming 2,333 tons of ore containing 35

[3] Storms, Walter R., Mining Methods and Costs at the Atlas No. 2 Zinc-Lead Mine, West Pinos Altos Mining District, Grant County, N. Mex.: Bureau of Mines Inf. Cir. 7524, 1949, 11 pp.

ounces of gold, 3,220 ounces of silver, 9,328 pounds of copper, 479,515 pounds of lead, and 34,258 pounds of zinc. The mine was taken over November 1 by Strong & Harris, Inc., which carried on development work on the 205-foot level. Still Bros. remodeled a fluorspar mill at Lordsburg and treated ore from the Waldo and Last Chance mines. Other small producers included the Francis K. and Ruth mines.

San Simon District.—Output in 1949 comprised lead-silver-zinc and lead-silver ore from the Silver Hill, Bob Montgomery, King, McGhee, and S. & W. properties.

LINCOLN COUNTY

Nogal (Bonita, Parsons) District.—A truckload each of lead-silver ore was shipped from the Catherine and Silver King mines in 1949.

White Oaks District.—Gold ore was shipped from the Old Abe mine, under development by the Q. B. Q. Co., Inc.

LUNA COUNTY

Cooks Peak District.—The Ethel, Lookout, Rimrock, and Summit mines shipped lead-silver ore in 1949.

Deming District.—The Peru Mining Co. operated its 1,000-ton selective flotation mill at Wemple, 5 miles north of Deming, from January 1 to June 17. The ore treated comprised 82,992 tons from the company Kearney and Pewabic mines in Grant County and 6,902 tons of custom ore from other mines in Grant, Hidalgo, Santa Fe, and Dona Ana Counties and one mine in Arizona. The American Smelting & Refining Co. began work May 1 on constructing a 400-ton selective-flotation mill at Deming for treating company ore from the Ground Hog mine and other custom ores.

OTERO COUNTY

Sacramento District.—M. F. Drunzer shipped a car of lead ore from the Sacramento mine in 1949.

SANTA FE COUNTY

Cerrillos District.—The Cash Entry-Franklin group was operated in 1949 by Moses Enterprises, Inc., from July 1 to December 5. The company drove 50 feet of tunnel and operated the mine and 50-ton mill intermittently. The mill product was lead-silver concentrate. Some ore was shipped from the Marshall Bonanza and Tom Payne mines.

San Pedro or New Placers District.—A lessee at the San Pedro Copper mine shipped a car of copper-gold-silver ore in 1949. A little gold was recovered from the Golden placer.

SIERRA COUNTY

Chloride (Apache, Cuchillo Negro) District.—The Dobies mine, operated in 1949 by Ira L. Moseley, produced 217 tons of ore containing 66,917 pounds of lead, 526 pounds of copper, and 22 ounces of silver. Some copper-silver-gold ore was shipped from the Alta Vista mine, and a little lead ore was produced from the End of the World claim.

Hermosa (Lower Palomas Creek) District.—Alvin W. Emerick worked at his Palomas Chief mine throughout 1949 and shipped 26 tons of ore

containing 731 ounces of silver, 238 pounds of copper, and 1,887 pounds of lead.

Kingston District.—Some ore was shipped from the Kingston and Superior mines in 1949.

Las Animas (Hillsboro) District.—The Bigelow and Snake mines produced a little gold-silver-copper ore.

Pittsburg and Caballos Mountains District.—Lead-silver ore was shipped from the Readjuster mine and concentrated in the Hanson mill at Hot Springs.

Tierra Blanca District.—Assessment work was done at the Lookout mine, and about 50 tons of gold ore were milled for testing in a 2-ton stamp mill on the property.

SOCORRO COUNTY

Hansonberg District (17 miles southeast of Carthage).—The Portales Mining Co. continued to operate its lead mine in 1949. The ore was trucked 30 miles to the company mill at San Antonio for treatment. Some lead ore was shipped in April from the Royal Flush group. This group, comprising 8 claims, and the Mex-Tex group of 50 claims was acquired by the Mex-Tex Mining Co., Inc., September 1, 1949. The new company worked on constructing a 500-ton ore-reduction mill near San Antonio designed to recover lead-silver concentrate, barite, and fluorspar as separate commercial products. The company is also operating a barite-grinding plant.

Magdalena District.—The Waldo zinc-lead mine and 200-ton flotation mill, operated by the American Smelting & Refining Co. (owner) since April 1943, were in production in 1949 from January 1 through June 3, when mining operations were terminated and the mill was shut down. The mill was reopened later to treat custom ore. Lessees operated the Kelly group (including the Lynchburg mine), shipping most of the ore produced to the Empire Zinc Co. mill at Hanover (Grant County) for treatment; the rest (including considerable dump ore) was treated in the Waldo mill. Other producers were the Nitt, Queen, Juanita, and Maher (Metals Limited) groups.

Oregon

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By R. B. Maurer

GENERAL SUMMARY

OREGON gold production in 1949, due principally to dredging, exceeded the 1948 output by 11 percent but was considerably below the postwar peak of 18,979 ounces attained in 1947, whereas 1949 silver production fell 10 percent below the relatively small yield of the metal in 1948. Renewed interest in exploiting the State ores for base metals in 1949 resulted in a small zinc production—the first reported since 1947, a tenfold increase in copper production, and a 71-percent increase in the yield of lead compared with minor outputs of the two metals in 1948.

The total value of the gold, silver, copper, lead, and zinc (in terms of recoverable metals) produced in Oregon was $592,107 in 1949 compared with $527,064 in 1948 and $4,148,271 in the peak year 1940. It was divided among the metals as follows: Gold, 96 percent; silver, 2 percent; and copper, lead and zinc combined, 2 percent. Grant County replaced Baker County as the leading metal producer in 1949, due largely to increased output from both bucket-line and dragline dredging, and contributed 54 percent of the State total value. Baker County, in second place, supplied 36 percent.

Placer mines contributed 89 percent and lode mines 11 percent of the gold produced in Oregon in 1949. In 1948 the ratio was placer mines 86 percent and lode mines 14 percent.

The 57 Oregon mines (28 lode and 29 placer) that reported production in 1949 represent a decrease of 81 percent in the number of operations compared with the 304 producing mines (112 lode and 192 placer) in 1940—the year of highest recorded total value of output of gold, silver, copper, lead and zinc in Oregon.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are bank measure; that is, the material is measured in the ground before treatment.

The value of metal production reported herein has been calculated at the prices in the accompanying table.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price of newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1945–49, and total, 1852–1949, in terms of recoverable metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	9	10	1,378	4,467	$156,345	10,461	$7,439
1946	23	37	3,246	17,598	615,930	6,927	5,597
1947	20	49	3,277	18,979	664,265	30,379	27,493
1948	23	38	3,119	14,611	511,385	13,596	12,305
1949	28	29	6,215	16,226	567,910	12,195	11,037
1852–1949			(2)	5,741,368	128,910,923	5,281,482	4,845,270

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	1	$270	1	$172	1	$230	$164,456
1946	7	2,268	2	436			624,231
1947	14	5,880	12	3,456	1	242	701,336
1948	2	868	7	2,506			527,064
1949	20	7,880	12	3,792	6	1,488	592,107
1852–1949	12,379	4,655,191	779	86,535	148	15,806	138,513,725

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Figure not available.

Gold.—Gold production in Oregon in 1949, including the fine-gold content of "natural gold" sold on the open market, increased 11 percent compared with 1948. Gold from placer mines, up 16 percent over 1948, was 89 percent of the State output; of the placer total, bucket-line dredges recovered 74 percent, dragline dredges 22 percent, hydraulicking 2 percent, and nonfloating washing plants (with mechanical excavators), drift mining, and small-scale hand methods together 2 percent. Lode gold decreased 16 percent compared with 1948, and 73 percent of the 1949 output was the yield from two mines. More than 99 percent of the lode gold produced was from dry gold ore and old tailings; the remainder was derived from dry silver ore and copper ore.

The following 5 producers, listed in order of output, supplied 87 percent of the State total: Baker Dredging Co. and Porter & Co. (bucket-line dredges); Calhoun & Howell of Oregon Ltd. (dragline

dredge); Buffalo Gold Dredging Co. (bucket-line dredge); and Bartels Bros. Mining Co., Champion mine (lode).

Monthly output for 1949—shown in the accompanying table—after winter operational curtailments reflects the fairly uniform yield from the major dredges augmented sporadically by output from other placer operations from April to December and from lode mines.

Gold produced at placer mines in Oregon, 1945–49, by classes of mines and by methods of recovery

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average value per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucket-line dredges:					
1945	3	1,895,000	3,763	$131,705	$0.070
1946	4	5,116,000	13,793	482,755	.094
1947	2	[2] 3,976,500	[2] 12,164	[2] 425,740	[2] .107
1948	2	[2] 3,525,300	[2] 9,842	[2] 344,470	[2] .098
1949	3	3,468,900	10,744	376,040	.108
Dragline: [3]					
1945	--------	--------	--------	--------	--------
1946	9	252,000	1,910	66,850	.265
1947	12	1,093,000	4,984	174,440	.160
1948	6	393,900	2,048	71,680	.182
1949	3	594,750	3,224	112,840	.190
Suction dredges: [4]					
1945	--------	--------	--------	--------	--------
1946	2	15,000	155	5,425	.362
1947–49	--------	--------	--------	--------	--------
Nonfloating washing plants: [5]					
1945	--------	--------	--------	--------	--------
1946	1	4,200	45	1,575	.375
1947	5	(2)	(2)	(2)	(2)
1948	3	(2)	(2)	(2)	(2)
1949	4	12,700	54	1,890	.149
Gravel hydraulically handled:					
Hydraulic:					
1945	5	43,000	170	5,950	.138
1946	8	114,000	406	14,210	.125
1947	19	72,200	325	11,375	.158
1948	21	84,300	412	14,420	.171
1949	13	59,100	255	8,925	.151
Small-scale hand methods: [6]					
Wet:					
1945	2	3,000	53	1,855	.618
1946	10	16,800	174	6,090	.363
1947	11	8,300	175	6,125	.738
1948	5	8,900	210	7,350	.826
1949	5	21,600	181	6,335	.293
Underground placers:					
Drift:					
1945	--------	--------	--------	--------	--------
1946	3	1,000	19	665	.665
1947	--------	--------	--------	--------	--------
1948	1	350	10	350	1.000
1949	1	250	7	245	.980
Grand total placers:					
1945	10	1,941,000	3,986	139,510	.072
1946	37	5,519,000	16,502	577,570	.105
1947	49	5,150,000	17,648	617,680	.120
1948	38	4,012,750	12,522	438,270	.109
1949	29	4,157,300	14,465	506,275	.122

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Data for nonfloating washing plants included with bucket-line dredges to avoid disclosure of individual output.
[3] Includes all placer operations using dragline excavator for delivering gravel to floating washing plant.
[4] Includes all placer operations using suction pump for delivering gravel to floating washing plant, except those producing less than 100 ounces of gold, which are included with "small-scale hand methods."
[5] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."
[6] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, etc.

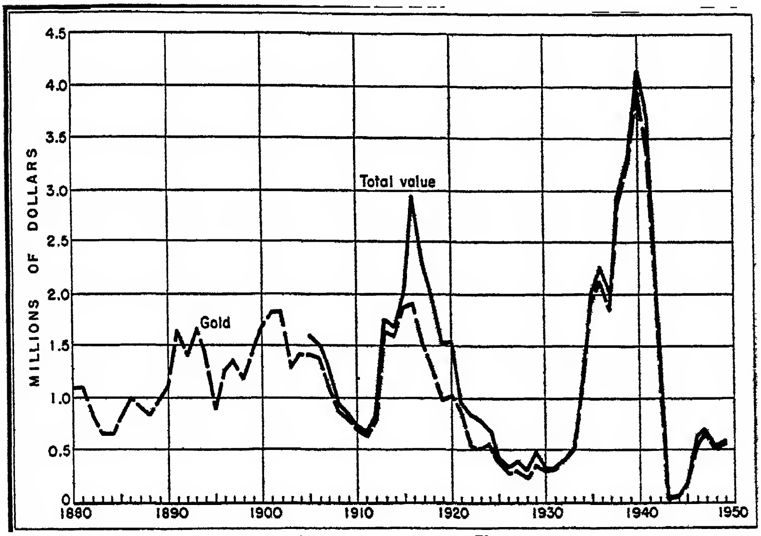

FIGURE 1.—Value of mine production in Oregon of gold, 1880–1949, and total value of gold, silver, copper lead, and zinc, 1905–49.

Mine production of gold and silver in Oregon in 1949, by months, in fine ounces of recoverable metal

Month	Gold	Silver	Month	Gold	Silver
January	303	272	August	2,198	2,075
February	247	43	September	1,509	1,920
March	862	181	October	1,701	2,052
April	1,552	296	November	1,653	946
May	1,406	246	December	1,441	1,266
June	2,011	716			
July	1,343	2,182	Total: 1949	16,226	12,195
			1948	14,611	13,596

Silver.—Oregon silver production in 1949 decreased 10 percent below the low level of 1948. More than 99 percent of the State total came from Grant, Lane, and Baker Counties; 74 percent was recovered from gold ore and old tailings, 22 percent from placer gravels, nearly 4 percent from silver ore, and less than 1 percent from copper ore.

Copper, Lead, and Zinc.—Renewal of mining and milling operations in the Bohemia district, Lane County, during 1949 accounted for the revival of zinc production—dormant since 1947—and most of the increase in Oregon copper and lead production over the almost negligible outputs of the two metals in 1948. The Champion mine (Bartels Bros. Mining Co.) was the principal producer of Oregon copper in 1949, whereas Helena Mines, Inc., operating the Helena and Musick mines, was the sole producer of zinc in Oregon and the leader in lead output.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1949 by counties, in terms of recoverable metals

County	Mines producing [1]		Gold					
			Lode		Placer		Total	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Baker	9	6	185	$6,475	5,774	$202,090	5,959	$208,565
Curry	2		20	700			20	700
Douglas	2	2	32	1,120	9	315	41	1,435
Grant and Wheeler [2]	3	8	695	24,325	8,374	293,090	9,069	317,415
Jackson	4	4	76	2,660	96	3,360	172	6,020
Josephine	5	8	36	1,260	205	7,175	241	8,435
Lane	3		717	25,095			717	25,095
Malheur		1			5	175	5	175
Union		(3)			2	70	2	70
Total: 1949	28	29	1,761	61,635	14,465	506,275	16,226	567,910
1948	23	38	2,089	73,115	12,522	438,270	14,611	511,385

County	Silver (lode and placer) [4]		Copper		Lead		Zinc		Total value
	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Baker	2,880	$2,606	400	$79					$211,250
Curry	4	4							704
Douglas	10	9							1,444
Grant and Wheeler [2]	5,365	4,856	800	158	6,600	$1,043			323,472
Jackson	30	27							6,047
Josephine	52	47	5,800	1,142					9,624
Lane	3,853	3,487	33,000	6,501	17,400	2,749	12,000	$1,488	39,320
Malheur	1	1							176
Union									70
Total: 1949	12,195	11,037	40,000	7,880	24,000	3,792	12,000	1,488	592,107
1948	13,596	12,305	4,000	868	14,000	2,506			527,064

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Combined to avoid disclosure of individual output.
[3] From property not classed as a mine.
[4] Sources of total silver as follows—1949: 9,488 ounces from lode mines and 2,707 from placers; 1948: 10,939 ounces from lode mines and 2,657 from placers.

MINING INDUSTRY

Although 28 Oregon lode mines reported production in 1949 compared with 23 mines in 1948 and 99 percent more ore and tailings were treated in 1949 than in the previous year, the value of gold, silver, copper, lead, and zinc produced at lode mines during 1949 declined $3,007 or 4 percent. Of the 6,215 tons of ore (including 472 tons of old tailings) treated in 1949, Lane County produced 65 percent, Grant County 17 percent, Baker County 14 percent, and Curry, Douglas, Jackson, Josephine and Wheeler Counties together 4 percent. Nearly 99 percent of the total (including all the old tailings) was dry gold ore and the remainder dry silver ore and copper ore.

The three properties worked by bucket-line dredge had one dredge each; one operated throughout the year and the others were idle at intervals during 1949. Three dragline dredges washed gravel during various periods of 1949, but only one operated at the close of the year. Twenty-three other placer mines were worked sporadically during 1949.

Ore and old tailings sold or treated in Oregon in 1949, with content in terms of recoverable metals

Source	Material sold or treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
Dry gold ore	5,650	472	1,758	9,035	33,900	24,000	12,000
Dry silver ore	47		1	431	300		
Copper ore	46		2	22	5,800		
Total lode mines	5,743	472	1,761	9,488	40,000	24,000	12,000
Placers			14,465	2,707			
Total: 1949	5,743	472	16,226	12,195	40,000	24,000	12,000
1948	3,103	16	14,611	13,596	4,000	14,000	

METALLURGICAL INDUSTRY

Of the State total ore and old tailings (6,215 tons), 87 percent was treated in mills and 13 percent was shipped crude to smelters. Ultimate recovery of nearly 47 percent of the total lode gold was from smelting of concentrates, nearly 38 percent was from the smelt ng of ore, 15 percent was as bullion from amalgamation of ore, and less than 1 percent from cyanidation of ore. Of the lode silver recovered, 63 percent was from concentrate smelted, 36 percent from ore and old tailings smelted, and 1 percent from ore amalgamated and cyanided. Smelting of concentrates accounted for 51 percent of the copper, 75 percent of the lead, and all the recoverable zinc, whereas 49 percent of the copper and 25 percent of the lead ore recovered was from direct smelting of ore. All material requiring smelting was shipped out of the State.

Mine production of metals in Oregon by methods of recovery, in 1949, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Amalgamation	266	94			
Cyanidation	9	3			
Concentrates smelted	822	6,010	20,200	18,000	12,000
Ore smelted	664	3,381	19,800	6,000	
Placer	14,465	2,707			
Total: 1949	16,226	12,195	40,000	24,000	12,000
1948	14,611	13,596	4,000	14,000	

Mine production of metals from mills in Oregon, by counties, in 1949, in terms of recoverable metals

	Material treated		Recoverable in bullion		Concentrates smelted and recoverable metal					
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES										
Baker	688	165	101	61	42	83	1,369	100		
Curry	75		20	4						
Douglas	32		32	10						
Grant and Wheeler [1]	711	300	69	13	70	440	2,863	500	5,200	
Jackson	46		24	5						
Josephine	14	7	29	4						
Lane	3,390				198	299	1,778	19,600	12,800	12,000
Total: 1949	4,956	472	275	97	310	822	6,010	20,200	18,000	12,000
1948	2,950	16	546	116	176	1,009	9,390	1,700	11,000	
BY CLASSES OF CONCENTRATES										
Dry gold					49	248	1,167	300	2,500	
Dry gold-silver					38	72	1,367	100		
Copper					152	259	1,531	17,800	4,800	
Lead					25	203	1,698	200	2,700	
Zinc-lead					46	40	247	1,800	8,000	12,000
Total 1949					310	822	6,010	20,200	18,000	12,000

[1] Combined to avoid disclosure of individual output.

Gross metal content of concentrates produced from ores mined in Oregon in 1949, by classes of concentrates

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	49	248	1,167	404	2,623	3,645
Dry gold-silver	38	72	1,367	161		
Copper	152	259	1,531	18,367	8,722	
Lead	25	203	1,698	346	2,792	2,915
Zinc-lead	46	40	247	2,051	8,121	15,990
Total: 1949	310	822	6,010	21,329	22,258	22,550
1948	176	1,009	9,390	1,996	11,446	12,917

Mine production of metals from Oregon crude ore shipped to smelters in 1949, in terms of recoverable metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
BY COUNTIES					
Baker	47	1	431	300	
Grant	48	186	840	300	1,400
Jackson	9	52	9		
Josephine	53	7	26	5,800	
Lane	630	418	2,075	13,400	4,600
Total: 1949	787	664	3,381	19,800	6,000
1948	153	534	1,433	2,300	3,000
BY CLASSES OF ORE					
Dry gold	694	661	2,928	13,700	6,000
Dry silver	47	1	431	300	
Copper	46	2	22	5,800	
Total 1949	787	664	3,381	19,800	6,000

Gross metal content of Oregon crude ore shipped to smelters in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	694	661	2,928	14,212	9,475	3,226
Dry silver	47	1	431	365		187
Copper	46	2	22	6,021		
Total: 1949	787	664	3,381	20,598	9,475	3,413
1948	153	534	1,433	2,564	3,143	4,061

REVIEW BY COUNTIES AND DISTRICTS

BAKER COUNTY

Cracker Creek District.—Lloyd Anderson operated the Bald Mountain mine during 1949 recovering gold and silver by amalgamation. Some gold-silver concentrate produced from the gold ore was shipped to a smelter.

Rock Creek District.—John Arthur shipped 47 tons of fluxing ore containing 1 ounce of gold, 431 ounces of silver, and 365 pounds of copper to a smelter from the Chloride mine in 1949.

Sumpter District.—Baker Dredging Co., operated a Yuba-type electric bucket-line dredge at Sumpter Valley placers throughout 1949. Brockton-Nevada Mining Syndicate worked the former Harris property in Sumpter Valley by dragline dredge in 1949.

Upper Burnt River District.—Lloyd M. McCullough hydraulicked the Theresa K mine 14 miles west of Durkee, Oregon, from March 28 to December 1, 1949; 500 cubic yards of gravel washed yielded 26 ounces of gold and 3 ounces of silver.

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1949, by counties and districts,[1] in terms of recoverable metals

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (lode and placer,[3] fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Baker County:											
Baker	1	1	15	10	53	63	14				$2,217
Cracker Creek	1		400	114		114	1,414	100			5,290
Greenhorn [4]	1	1	5	3	29	32	12				1,131
Rock Creek	1		47	1		1	431	300			484
Sparta	2		78	24		24	8				847
Upper Burnt River	2	1	285	28	32	60	8				2,107
Virtue	1	1	70	5	37	42	4				1,474
Curry County: Chetco	2		75	20		20	4				704
Douglas County:											
Green Mountain	1		30	26		26	9				918
Riddle		2			9	9					315
Umpqua (Wolf Creek)	1		2	6		6	1				211
Grant County:											
Canyon		4			1,517	1,517	140				53,222
Greenhorn [4]	1		300	1		1					35
Quartzburg		(5)			3	3					105
Susanville		1			13	13	1				456
Jackson County:											
Ashland	1		15	1		1					35
Gold Hill	2	1	20	57	16	73	12				2,566
Jacksonville		2			67	67	10				2,354
Upper Applegate	1	1	20	18	13	31	8				1,092
Josephine County:											
Galice	1	1	5	18	5	23	3				808
Grants Pass		(5)			15	15	2				527
Greenback	1	3	4	10	152	162	17				5,685
Illinois River	1	1	46	2	6	8	22	5,800			1,442
Lower Applegate	1		12	3		3	4				108
Waldo	1	3	7	3	27	30	4				1,054
Lane County: Bohemia	3		4,020	717		717	3,853	33,000	17,400	12,000	39,320
Malheur County: Mormon Basin		1			5	5	1				176
Union County: Grande Ronde		(5)			2	2					70
Wheeler County: Spanish Gulch	(6)	(6)	(6)	(6)	(6)	(6)	(6)				(6)
Other districts [7]	2	5	759	694	12,464	13,158	6,213	800	6,600		467,354
Total Oregon	28	29	6,215	1,761	14,465	16,226	12,195	40,000	24,000	12,000	592,107

[1] Only those counties and districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnote 7 and their output included with "Other districts."
[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[3] Source of silver: 9,488 ounces from lode mines and 2,707 ounces from placers.
[4] Greenhorn district is in Baker and Grant Counties.
[5] From property not classed as a mine.
[6] Included with "other districts."
[7] Includes Sumpter district in Baker County, Granite and North Fork districts in Grant County, and Spanish Gulch district in Wheeler County.

CURRY COUNTY

Chetco District.—W. D. Bowser amalgamated 65 tons of ore from the Bowser No. 1 and Robert E mines; 20 ounces of gold and 4 ounces of silver were recovered.

GRANT COUNTY

Canyon District.—Buffalo Gold Dredging Co. operated a Walter Johnson Diesel bucket-line dredge with eighty-four 6-cubic-foot buckets on the South Fork of John Day River in 1949; 1,499 ounces of gold and 138 ounces of silver were recovered from 567,986 cubic yards of gravel handled. Dredging operations ceased September 29, 1949.

Granite District.—Porter & Co. operated its Yuba-type electric bucket-line dredge with sixty 4½-cubic-foot buckets on Olive Creek from April 1 to December 20, 1949. The Buffalo mine, second largest producer of lode gold in Oregon in 1949, was worked by R. G. Amidon for the estate of Bruce Dennis throughout the year. Gold ore treated in a 30-ton flotation mill yielded concentrates, containing gold, silver, and some copper and lead, which were shipped to a smelter. Some small shipments of gold ore were made direct to smelters.

North Fork District.—Calhoun & Howell operated its Diesel dragline dredge on the North Fork of the John Day River during 1949.

JACKSON COUNTY

Gold Hill District.—George Tulare, operating the Sylvanite mine in 1949, amalgamated 11 tons of ore and recovered 5 ounces of gold and 1 ounce of silver.

JOSEPHINE COUNTY

Galice District.—Bert Pankey hydraulicked the Maloney mine from February 15 to April 15, 1949; 700 cubic yards of gravel washed yielded 5 ounces of gold.

Illinois River District.—Ben B. Baker and J. E. Hamlen operated the Onion Falls mine from May 1 to September 15, 1949; 46 tons of copper ore shipped to a smelter contained 2 ounces of gold, 22 ounces of silver, and 6,021 pounds of copper.

Waldo District.—Earle N. Young leased the Rainbow mine from July to December 1949 and recovered 3 ounces of gold and 1 ounce of silver from 7 tons of ore cyanided.

LANE COUNTY

Bohemia District.—Bartels Bros. Mining Co. operated the Champion mine and flotation mill during 1949. Copper concentrate (containing values in gold, silver, and lead) recovered from the gold ore milled was shipped to a smelter. In addition, gold ore was shipped for direct smelting. Helena Mines, Inc., and Harold Barton, lessee, worked the Helena mine from August to November 1949; 18 tons of zinc-lead concentrate, containing 15 ounces of gold, 102 ounces of silver, 888 pounds of copper, 2,863 pounds of lead, and 7,358 pounds of zinc produced from 130 tons of gold ore milled at the Champion mine and 34 tons of gold ore containing 20 ounces of gold, 68 ounces of silver, 1,173 pounds of copper, 1,978 pounds of lead, and 1,500 pounds of zinc, were shipped to smelters. Helena Mines, Inc., leasing the Musick mine from the Tar Baby Mining Co., shipped 485 tons of dump ore to the Champion mill during 1949. The zinc-lead concentrate produced (28 tons containing 25 ounces of gold, 145 ounces of silver, 1,163 pounds of copper, 5,258 pounds of lead, and 8,632 pounds of zinc) was shipped to a smelter. Data on mines and prospects in this district were published.[1]

MALHEUR COUNTY

Mormon Basin District.—Frank E. Deem recovered 5 ounces of gold and 1 ounce of silver by ground-sluicing and dry-washing 75 cubic yards of gravel at the Bam Tree group of claims in 1949.

[1] Taber, John W., A Reconnaissance of Lode Mines and Prospects in the Bohemia Mining District, Lane and Douglas Counties, Oreg.: Bureau of Mines Inf. Circ. 7512, 1949, 50 pp.

South Dakota
Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. Martin

GENERAL SUMMARY

GOLD mining is the principal mineral industry of South Dakota. The mines are in a small area comprising parts of Lawrence, Pennington, and Custer Counties in the Black Hills. The Homestake mine at Lead, Lawrence County, is the largest gold-producing mine in the United States. Silver is recovered regularly as a byproduct of gold mining. Some copper and lead are produced occasionally, and zinc-lead ore was produced by one mine in several of the years since 1942.

The State output of gold in 1949 increased 19 percent over 1948. Production from the Homestake mine during the last 6 months of 1949 reached the highest rate of the postwar period. Since the mine resumed operations after the wartime shut-down, it has not operated a full year at normal productive capacity because of the limited number of men available for underground work. Output from the Bald Mountain mine at Trojan, an important gold producer, was a little higher than in 1948.

Production of gold and silver by other South Dakota properties was small. The lead credited to the output in 1949 was contained in lead-gold-silver concentrate produced in 1948 at the Belle Eldridge mine but not shipped until 1949.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in South Dakota, 1945–49, and total, 1876–1949, in terms of recoverable metals [1]

Year	Mines producing: Lode	Mines producing: Placer	Ore (short tons)	Gold (lode and placer): Fine ounces	Gold (lode and placer): Value	Silver (lode and placer): Fine ounces	Silver (lode and placer): Value
1945	3		312,612	55,948	$1,958,180	26,564	$18,890
1946	5		872,242	312,247	10,928,645	86,901	70,216
1947	4		939,384	407,194	14,251,790	111,684	101,074
1948	6		1,005,339	377,850	13,224,750	94,693	85,702
1949	5	1	1,230,172	464,650	16,262,750	109,383	98,997
1876–1949			(2)	22,295,995	561,957,034	10,003,769	7,185,831

Year	Copper: Short tons	Copper: Value	Lead: Short tons	Lead: Value	Zinc: Short tons	Zinc: Value	Total value
1945							$1,977,070
1946							10,998,861
1947			8	$2,304	19	$4,598	14,359,766
1948			16	5,728	29	7,714	13,323,894
1949			4	1,264			16,363,011
1876–1949	106	$36,466	483	67,796	265	56,406	569,303,533

[1] For total production of gold and silver in South Dakota, by years, see Mineral Resources, 1913, pt. 1, p. 42; Mineral Resources, 1922, pt. 1, p. 194; and subsequent volumes of Mineral Resources and Minerals Yearbook.
[2] Figure not available.

Mine production of gold, silver, lead, and zinc in South Dakota, 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Lead (short tons)	Zinc (short tons)
January	31,612	7,626		
February	32,032	7,116		
March	38,277	8,706		
April	39,907	9,049		
May	35,737	8,485		
June	34,552	8,774	4	
July	41,012	9,724		
August	43,560	10,201		
September	38,551	8,686		
October	40,512	9,689		
November	42,924	10,229		
December	45,974	11,098		
Total: 1949	464,650	109,383	4	
1948	377,850	94,693	16	29

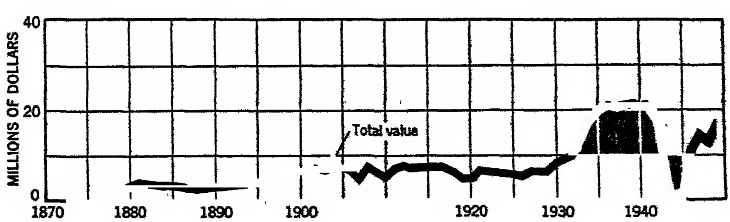

FIGURE 1.—Total value of mine production of gold and silver in South Dakota, 1876–1949

MINE PRODUCTION BY COUNTIES

The entire South Dakota output of gold, silver, and lead in 1949 came from Lawrence County. The production figures for this county are therefore the same as those shown for 1949 in the foregoing State tables. In 1948 all the State output came from Lawrence County except 14 ounces of gold from Pennington County. Custer County has had no production of gold or silver since 1941.

MINING AND METALLURGIC INDUSTRY

Details of mining and milling in South Dakota are given in the following Review by Counties. A break-down of ore-treatment methods shows that 1,112,183 tons of ore, yielding 447,071 ounces of gold and 83,528 ounces of silver, were treated by amalgamation followed by cyanidation of sands and slimes; 117,979 tons, yielding 17,555 ounces of gold and 25,632 ounces of silver, were treated by cyanidation only; and 10 tons, yielding 10 ounces of silver, were treated by amalgamation only. Sixteen tons of lead concentrate derived from zinc-lead ore milled and recorded in 1948 were shipped in 1949; the yield, in terms of recoverable metals, was 23 ounces of gold, 213 ounces of silver, and 4 tons of lead. One ounce of gold was recovered by placering.

Gold and silver bullion produced at mills in South Dakota by amalgamation, 1945–49

Year	Ore treated (short tons)	Gold in bullion (fine ounces)	Silver in bullion (fine ounces)	Quicksilver used (pounds)
1945	298,830	35,398	7,254	1,500
1946	793,034	197,425	35,498	(1)
1947	849,123	262,257	52,057	(1)
1948	896,932	250,782	72,100	(1)
1949	1,112,193	312,676	83,538	(1)

[1] Figure not available.

Gold and silver bullion produced at mills in South Dakota by cyanidation, 1945–49

Year	Material treated (short tons)			Gold in bullion product (fine ounces)	Silver in bullion product (fine ounces)	Sodium cyanide used [1] (pounds)
	Crude ore	Sands and slimes	Total			
1945	13,782	237,503	251,285	20,550	19,310	109,900
1946	79,208	783,103	862,311	114,822	51,403	(2)
1947	86,511	848,875	935,386	144,888	59,092	(2)
1948	106,927	896,567	1,003,494	126,998	21,669	(2)
1949	117,979	1,112,183	1,230,162	151,950	25,632	(2)

[1] In terms of 96- to 98-percent strength.
[2] Figure not available.

REVIEW BY COUNTIES

LAWRENCE COUNTY

Homestake Mine.—The Homestake mine operated continuously in 1949. Ore milled averaged 3,047 tons daily, 7 days a week, compared with 2,450 tons in 1948. The rated capacity of the mills is 4,000 tons. More men became available for underground work during 1949, and production in the latter half of the year showed a large increase over the first half. The mine is opened by three vertical shafts, the deepest being 4,245 feet, and an inside winze to the 5,000-foot level. Development during the year included 24,979 feet of drifts, 12,436 feet of raises, and 32,882 feet of diamond drilling. The primary crushing plants are at the hoists. Other surface plants include the 180-stamp South mill (the main secondary crushing, grinding, and amalgamating plant), cyanide sand plant No. 1, cyanide sand plant No. 3, and the refinery—all at Lead—and the slime plant at Deadwood. At the refinery silver is parted from the gold, and virtually pure metals are shipped to the Denver Mint. The following data are extracted from the annual report of the general manager of the Homestake Mining Co. for the year ended December 31, 1949:

Ore mined in 1949 was 1,112,183 tons, which compared with 896,862 tons in 1948. Bullion with value of $15,683,159.05 was produced, which is $3,025,020.50 more than in 1948. Average realization was $14.10 per ton and metallurgical recovery was 96.98 percent, the highest recovery ever achieved by the company. Increased production resulted directly from increase in the number of men available for underground work. The average number employed in the mine department during 1949 was 264 more than in 1948. On December 31, the mine department had 286 more employees than at the end of 1948. The full number of men required for the mine department was nearly reached in mid-November and since that time there was a slight increase only. * * * It is expected that output of ore will continue to increase to approach prewar production of 1,400,000 tons per year.

Following record snowfall in November 1948, the new year began with the most severe storm in the history of the Black Hills. Roads and railways were completely blocked for extended periods. Only one coal shipment was received at the company's Kirk power station in 3 weeks. The first carload shipment of supplies to be received in 1949 was delivered to our plant on February 8. This resulted in some curtailment in milling and in production from the sawmill because of shortage of power, and also increased cost for snow removal.

Operating expense per ton, exclusive of taxes and contribution to the Pension Trust, was 3.89 percent higher than in 1948 because of higher average wages, cost of supplies, and freight charges. Such expense was 62.6 percent higher than in 1941. With inclusion of the Pension Trust cost such expense was 9.04 percent higher than in 1948 and 70.7 percent higher than in 1941.

Broken ore in shrinkage stopes increased from 340,000 tons on December 31, 1948, to 461,000 tons at the end of 1949. The reserve of developed ore, including the broken ore, is 21,024,000 tons as compared with 21,454,000 tons at the end of 1948.

The mine and plant are in excellent condition. There were no interruptions of operations during the year, except that caused by the January storm.

Ore milled, receipts, and dividends, Homestake mine, 1945–49 [1]

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1945	298,828	$1,873,872.64	$6.2707	
1946	792,094	10,458,896.22	13.1891	$2,812,992
1947	849,023	13,796,720.25	16.2501	4,018,560
1948	896,862	12,658,138.55	14.1138	4,018,560
1949	1,112,183	15,683,159.05	14.1012	4,520,880

[1] From 1876 to 1949, inclusive, this mine yielded bullion and concentrates that brought a net return of $494,113,151 and paid $165,176,794 in dividends.

Other Mines.—The Bald Mountain Mining Co. operated its 370-ton mill at Trojan three shifts a day, 7 days a week throughout 1949. Ore milled averaged 323 tons daily compared with 291 tons in 1948. The company group of mines includes the Portland, Dakota, Clinton, Two Johns, Trojan, and other claims. Mine development during 1949 comprised 3,540 feet of drifts and crosscuts and 600 feet of raises. The ore-treatment process includes crushing to ⅝-inch size, ball milling in cyanide solution, thickening and agitation, countercurrent washing in four stages, Merrill-Crowe zinc-dust precipitation, and reduction of precipitate in a gas-fired reverberatory-type tilting furnace. Sulfide ores, when available, are bypassed from the crushing circuit, dry-rod-milled to 10-mesh, roasted, and returned to the ball mills. Gold recovered in 1949 totaled 17,544 ounces and silver 25,612 ounces.

The Frerichs Mining Co. recovered some gold and silver from ore milled at the Frerichs mine during January and February to test the mill equipment after changes had been made in the flow sheet. The Belle Eldridge mine was not worked in 1949, but 16 tons of lead-gold-silver concentrate produced in milling zinc-lead ore in 1948 were shipped in 1949. Some silver was recovered by amalgamating old tailings on the Branch Mint millsite, and 1 ounce of gold was produced by sluicing on Wildwood Creek.

Texas

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. Martin

GENERAL SUMMARY

THE MINE output of gold, silver, copper, and lead in Texas in 1949 was valued altogether at $55,003 compared with $75,611 in 1948. Four small-scale operations in Culberson, Hudspeth, and Presidio Counties in the western part of the State contributed to the production in 1949. Lead represented 76 percent of the total value in 1949 and 80 percent in 1948.

No output of zinc was reported from newly mined Texas ore in 1948 or 1949. Some of the old zinc-bearing slag accumulated in earlier years at the El Paso Smelting Works of the American Smelting & Refining Co. was re-treated along with current hot slag in the company slag-fuming plant put in operation in 1948. In the mine-production statistics the metals (principally zinc) recovered from domestic current hot slag are credited to the various shipping mines on the basis of the assay content of the ore and are thus apportioned to the States from which they came. Specific data on the quantity of metals recovered from the old slag accumulated before 1948 are not available, and this output is not included in the mine-production statistics.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold[1] (per fine ounce)	Silver[2] (per fine ounce)	Copper[3] (per pound)	Lead[3] (per pound)	Zinc[3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

MINE PRODUCTION

In total mine production from 1885 through 1949, silver was the principal metal produced in Texas, although the output has been small since large-scale operation of the Presidio mine at Shafter ceased in 1942. The following table shows the annual output of ore and the quantity and value of the metals recovered from Texas mines from 1945 to 1949, as well as the total metal production from 1885 to 1949.

Mine production of gold, silver, copper, lead, and zinc in Texas, 1945–49, and total, 1885–1949, in terms of recoverable metals

Year	Ore (short tons)	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
1945	2,693			23,265	$16,544
1946	6,705	9	$315	42,922	34,681
1947	4,552	45	1,575	20,547	18,595
1948	1,850	57	1,995	3,065	2,774
1949	2,140	40	1,400	2,691	2,435
1885–1949	[1]	8,432	229,065	33,294,666	23,438,865

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	55	$14,850					$31,394
1946	3	972	47	$10,246	44	$10,736	56,950
1947	6	2,520	78	22,464	22	5,324	50,478
1948 [2]	23	9,982	170	60,860			75,611
1949 [2]	24	9,456	132	41,712			55,003
1885–1949	1,362	392,001	5,215	624,731	810	122,551	24,807,213

[1] Figure not available.
[2] Does not include zinc and lead that were recovered by the slag-fuming plant at the El Paso smelter from old accumulated slag resulting from operations in previous years.

Mine production of gold, silver, copper, and lead in Texas in 1949, by counties, in terms of recoverable metals

County	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)
Culberson	1	22		54	1	1
Hudspeth	1	1,227		27	22	
Presidio	2	891	40	2,610	1	131
Total: 1949	4	2,140	40	2,691	24	132
1948	5	1,850	57	3,065	23	170

Mine production of gold, silver, copper, and lead in Texas in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)
January	3	191	3	7
February	6	414	6	29
March	2	244	4	16
April	5	378	6	16
May	2	198	4	6
June–July				
August		11	1	
September	10	548		27
October	6	351		18
November	3	156		6
December	3	200		7
Total: 1949	40	2,691	24	132
1948	57	3,065	23	170

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Texas in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)
Copper ore	2	1,249		81	23	1
Lead ore	2	891	40	2,610	1	131
Total: 1949	4	2,140	40	2,691	24	132
1948	5	1,850	57	3,065	23	170

METALLURGIC INDUSTRY

Smelters in Texas treat large tonnages of ore, concentrates, and fume from the various mining States and foreign countries, as well as substantial tonnages of smelter residues and secondary material from plants in Texas and other States east of the Rocky Mountain region.

The El Paso Smelting Works of the American Smelting & Refining Co. includes a copper and a lead smelter—each with an annual rated capacity in 1949 of 300,000 tons of ore and concentrates—and a slag-fuming plant for recovering zinc. Ores and concentrates received in 1949 came from mines in Arizona, Colorado, Missouri, New Mexico, Texas, Central America, Mexico, South-West Africa, Tasmania, Arabia, and Cuba. Other material treated included zinc-smelter residues, matte, and clean-up material from plants in various States and foreign countries.

The Phelps Dodge Corp. Nichols electrolytic copper refinery at El Paso treats blister-copper anodes cast at corporation smelters in Arizona. The plant employs about 800 men and operated continuously in 1949. It has a capacity of 240,000 tons of electrolytic copper annually and in addition produces some fire-refined copper. A copper sulfate (blue vitriol) section and a slime plant (for recovery of rare metals and gold, silver, and lead) are operated in connection with the electrolytic plant.

There are three zinc-reduction plants in Texas, all of which were active throughout 1949. The horizontal-retort smelter of the American Smelting & Refining Co. at Amarillo has an annual rated capacity of 56,500 tons of metal; in 1949 it received concentrates from mines in Arizona, California, Colorado, Montana, New Mexico, Nevada, and Utah and fume from Texas. The same company operates the electrolytic zinc plant at Corpus Christi. This plant has an annual capacity of approximately 34,000 tons of slab zinc and treats mostly foreign concentrates.

The horizontal-retort smelter of the American Zinc Co. of Illinois at Dumas can produce 48,000 tons of zinc metal annually. In 1949 it received concentrates from mines in Arizona and New Mexico, and zinc fume from slag-fuming plants in Utah and Idaho; the plant also treated a considerable tonnage of concentrates from foreign countries.

REVIEW BY COUNTIES

Culberson County.—J. J. Trepanier carried on development work in his Mary Ellen mine in the Diablo mountains 25 miles north of Van Horn from May to October 1949 and shipped 22 tons of copper-lead-silver ore to the El Paso smelter. The development included 82 feet of shaft and 86 feet of drifts.

Hudspeth County.—Copper ore was shipped from the Sancho Panza mine 7 miles northeast of Allamoore, operated several months in 1949 by A. P. Williams.

Presidio County.—R. I. Carr shipped lead ore from his leased properties 7 miles west of Shafter to the El Paso smelter. The results of investigations of these and adjacent properties by the Bureau of Mines were published.[1] The ore shipped in 1949 contained, besides lead, some silver and a little gold and copper. Several cars of lead-silver ore were shipped from the Silver Dome group 25 miles northwest of Presidio.

[1] McMillan, W. D., Investigation of Montezuma and Chinati Zinc-Lead Deposits, Shafter District, Presidio County, Tex.: Bureau of Mines Rept. of Investigations 4506, 1949, 26 pp.

Utah

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. Needham and Paul Luff

GENERAL SUMMARY

METAL mining in Utah in 1949 was erratic, and during much of the year it lacked the stimuli for outstanding production. Compared with 1948, yield of gold declined 15 percent, silver 16, copper 13, lead 5, and zinc 2; ore output dropped nearly 15 percent. Declines in the production of the five metals in 1949, coupled with lower average prices for base metals, brought about a 15-percent decrease in the value for gold, 16 for silver, 21 for copper, 16 for lead, and 9 for zinc. The value of the five metals in 1949 was $121,649,828, or 19 percent less than the value of $149,763,677 in 1948. Nevertheless the 1949 total was the fourth highest in the State's history and only 23 percent below the all-time record of $158,624,849 established in 1947. Of the total value in 1949, copper contributed 64 percent, lead 14, gold 9, zinc 8, and silver 5. Compared with 1948, the value of the metal production decreased 18 percent in the West Mountain (Bingham) district, and 32 in the Park City region, but only 2 in the Tintic district.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49; $0.9050505.

[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Utah, 1945–49, and total, 1864–1949, in terms of recoverable metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	89		24,723,184	279,979	$9,799,265	6,106,545	$4,342,432
1946	88	1	13,245,691	178,533	6,248,655	4,118,453	3,327,710
1947	118	2	30,383,114	421,662	14,758,170	7,780,032	7,040,929
1948	118	2	25,741,911	368,422	12,894,770	8,045,329	7,281,429
1949	93	2	21,993,467	314,058	10,992,030	6,724,880	6,086,356
1864–1949			[1] 647,721,180	11,747,120	311,374,240	741,722,760	544,494,476

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	226,376	$61,121,520	40,817	$7,020,524	33,630	$7,734,900	$90,018,641
1946	114,284	37,028,016	30,711	6,694,998	28,292	6,903,248	60,202,627
1947	266,533	111,943,860	49,698	14,313,024	43,673	10,568,866	158,624,849
1948	227,007	98,521,038	55,950	20,030,100	41,490	11,036,340	149,763,677
1949	197,245	77,714,530	53,072	16,770,752	40,670	10,086,160	121,649,828
1864–1949	5,501,226	1,660,569,917	4,577,760	540,371,450	1,108,844	169,663,307	3,226,473,390

[1] Figures estimated for certain years before 1901.

Mine production of gold, silver, copper, lead, and zinc in Utah in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	3,085	272,455	120	3,480	3,005
February	15,240	368,485	7,650	3,080	2,570
March	32,968	692,055	20,730	5,510	4,515
April	33,115	694,445	20,200	5,630	4,610
May	30,305	675,650	18,380	5,640	4,125
June	28,075	658,321	18,110	5,385	4,210
July	25,940	545,055	17,545	3,555	2,445
August	25,850	555,205	18,455	3,680	2,505
September	29,075	587,524	17,265	4,260	2,995
October	27,200	509,365	17,910	3,720	2,760
November	31,420	577,215	20,320	4,350	3,270
December	31,785	589,105	20,560	4,782	3,660
Total: 1949	314,058	6,724,880	197,245	53,072	40,670
1948	368,422	8,045,329	227,007	55,950	41,490

Gold.—Of the larger gold-producing properties in Utah in 1949, only the property of the Park Utah Consolidated Mines Co. in the Park City region reported a gain over 1948 output. Loss was especially large at the Utah Copper mine in Bingham Canyon, owing to the work stoppage which began in 1948 and continued until early February 1949.

Of the total gold in 1949, 85 percent came from copper ore, 12 from zinc-lead ore, 0.3 from other base-metal ores, and nearly 3 from gold and silver ores. Two placers reported production. The West Mountain (Bingham) district supplied 91 percent of the total, the Park City region 6, and the Tintic district nearly 2 precent. Output of the metal in the West Mountain (Bingham) district was 14 percent below that

in 1948 and in the Tintic district 53 percent, but in the Park City region it rose 2 percent.

The leading gold producers in Utah in 1949—each with an output of more than 1,000 ounces of recoverable metal—were as follows: Utah Copper mine and the United States & Lark group, both in the West Mountain (Bingham) district; the properties of the New Park Mining Co. and Park Utah Consolidated Mines Co., both in the Park City region; Eureka Lilly mine and the Chief Consolidated Mining Co. property, both in the Tintic district; Butterfield property in the West Mountain (Bingham) district; and the Calumet mine in the Rush Valley district. These eight properties furnished 98 percent of the State gold.

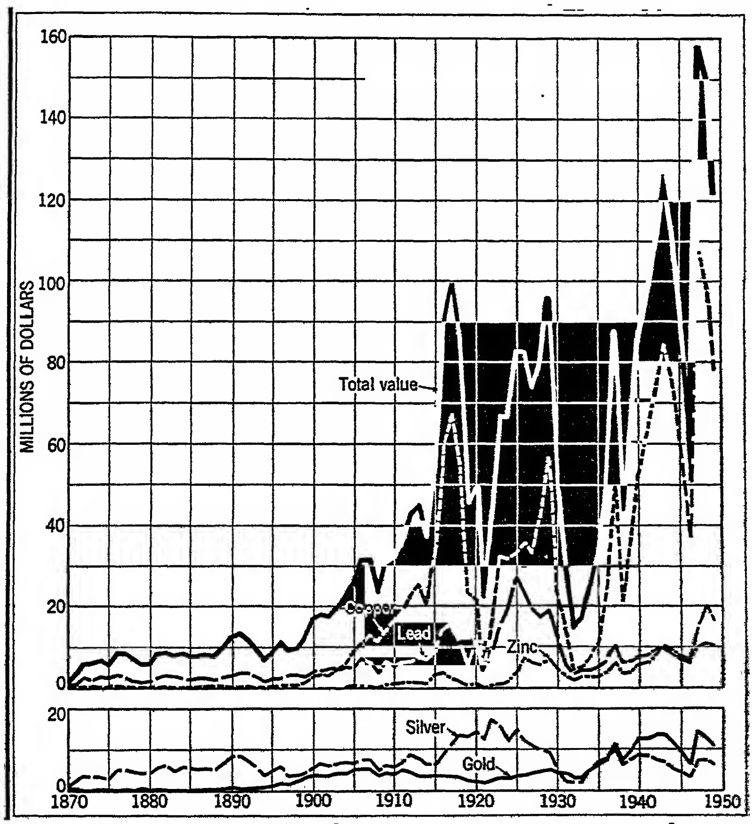

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc, and total value in Utah, 1870–1949.

Silver.—With the exception of the Butterfield property in the West Mountain (Bingham) district and the Daly No. 1 dump at Park City, all of the larger producers of silver in Utah reported smaller outputs in 1949 than in 1948. Decreases were especially notable at the Utah Copper mine and at the properties of the Park Utah Consolidated

Mines Co. and Silver King Coalition Mines Co. Yield of the metal dropped 8 percent in the West Mountain (Bingham) district, 38 in the Park City region, and 19 in the Tintic district.

Utah properties that produced more than 100,000 ounces of recoverable silver each in 1949 were as follows: Utah Copper mine, United State & Lark group, properties of Chief Consolidated Mining Co. and New Park Mining Co., Butterfield group, Park Utah Consolidated Mines Co. property, Daly No. 1 dump, Calumet mine, and Silver King Coalition Mines Co. property. These nine producers contributed 92 percent of the State silver.

Zinc-lead ore, zinc ore, lead ore, and zinc-lead-copper ore together furnished almost 57 percent of the State silver in 1949, copper ore 33 percent, and gold and silver ores 10 percent; the remainder came principally from zinc slag fumed.

Copper.—The Utah Copper mine in Bingham Canyon, Utah's only outstanding copper mine, experienced a work stoppage from October 24, 1948, to February 7, 1949. The loss from that part of the shutdown in 1949 is estimated to have been more than 60,000,000 pounds of recoverable copper, and that from the 1948 period 100,000,000 pounds. On June 1, the mine changed its workweek from 48 to 40 hours, which schedule was followed until Christmas. The effect of the strike and the shortened workweek was to reduce the output of copper at the mine about 13 percent below that in 1948. The United States & Lark group increased its copper output nearly 13 percent and was the only other Utah property to produce more than a million pounds of recoverable copper in 1949. These two producers contributed over 99 percent of the State copper.

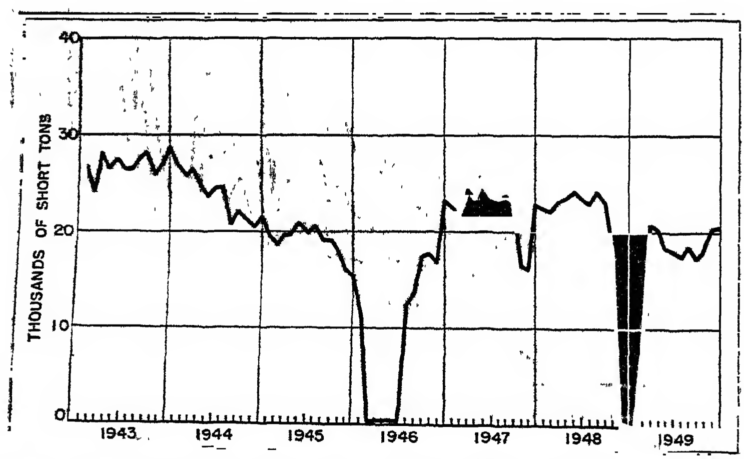

FIGURE 2.—Mine production of copper in Utah, by months, 1943-49, in terms of recoverable metal.

Lead.—Because of a reduced workweek early in May, followed by stoppages late in June at three of the large lead producers and serious curtailment at the fourth in the Park City region, output of lead in 1949 declined substantially at the properties of the New Park Mining Co., Park Utah Consolidated Mines Co., Silver King Coalition Mines Co., and Pacific Bridge Co. Production of the metal for the year also declined at the Calumet mine in the Rush Valley district. These losses were compensated in part by increases in lead yield from the United States & Lark group, Chief Consolidated Mining Co. property, Butterfield group, Cardiff mine, and the Hidden Treasure mine, and the return to production of the New Park Mining Co. property on September 15.

The leading State lead producers in 1949, each with an output of more than a million pounds of recoverable lead, were the United States & Lark group, properties of the Chief Consolidated Mining Co. and Park Utah Consolidated Mines Co., Butterfield group, Calumet mine, properties of New Park Mining Co. and Silver King Coalition Mines Co., Hidden Treasure mine (Ophir district), Pacific Bridge Co. property, and the Cardiff mine (Big Cottonwood district). These 10 producers supplied 94 percent of the State lead.

Of the total lead in 1949, 92 percent was recovered from zinc-lead ore and most of the remainder from lead ore, gold and silver ores, and zinc slag.

Zinc.—Although zinc made a better showing in Utah in 1949 than lead, the factors bringing about a decline in lead production in the Park City region also forced a decline in zinc output, and decreases were marked at the properties of the Silver King Coalition Mines Co., New Park Mining Co., and Pacific Bridge Co. Park Utah Consolidated Mines Co. reversed the district trend and reported an increase for the year at its property. The large gain at the property of the Chief Consolidated Mining Co. was chiefly responsible for the 65-percent increase in zinc output in the Tintic district. The Butterfield group and Hidden Treasure mine also had greater production of the metal than in 1948. The Calumet mine and the Tooele old slag pile failed to equal their 1948 figures.

Leading zinc producers in 1949, each with an output of more than a million pounds of recoverable metal, were the United States & Lark group, properties of the Chief Consolidated Mining Co., Park Utah Consolidated Mines Co., and New Park Mining Co., Butterfield group, Calumet mine, Tooele old slag pile, Hidden Treasure mine, Pacific Bridge Co. property, and Silver King Coalition mine. These 10 properties furnished about 97 percent of the State total zinc.

Zinc-lead ore was the source of 97 percent of the total zinc in 1949; old zinc slag furnished most of the remainder.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Utah in 1949, by counties, in terms of recoverable metals

County	Mines producing		Ore (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
Beaver	12		11,767	215	$7,525	11,880	$10,752
Box Elder	2		44	1	35	264	239
Grand		1		11	385		
Juab	12		137,771	2,204	77,140	772,864	699,481
Millard	2	1	36	1	35	52	47
Piute	4		1,281	182	6,370	17,367	15,718
Salt Lake	13		21,410,995	286,280	10,019,800	4,354,440	3,940,988
San Juan	1		6				
Summit	7		253,234	3,890	136,150	727,397	658,331
Tooele	21		88,724	2,769	96,915	349,502	316,317
Uintah	1		3			10	9
Utah	12		23,792	2,947	103,145	150,079	135,829
Wasatch	3		65,107	15,553	544,355	334,505	302,744
Washington	3		707	5	175	6,520	5,901
Total: 1949	93	2	21,993,467	314,058	10,992,030	6,724,880	6,086,356
1948	118	2	25,741,911	368,422	12,894,770	8,045,329	7,281,429

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaver	52,000	$10,244	302,500	$47,795	60,500	$7,502	$83,818
Box Elder	100	20	12,500	1,975			2,269
Grand							385
Juab	186,500	36,740	12,455,500	1,967,969	11,866,300	1,471,421	4,252,751
Millard	500	99	5,200	822			1,003
Piute	8,000	1,576	51,000	8,058			31,722
Salt Lake	392,261,000	77,275,417	66,567,300	10,517,633	45,540,000	5,646,960	107,400,798
San Juan	500	99					99
Summit	353,000	69,541	12,098,300	1,911,531	10,346,500	1,282,966	4,058,519
Tooele	714,500	140,756	8,400,000	1,327,200	6,513,200	807,637	2,688,825
Uintah			200	32	200	25	66
Utah	342,500	67,472	1,070,500	169,139	641,000	79,484	555,069
Wasatch	549,500	108,252	5,068,500	800,823	6,372,300	790,165	2,546,339
Washington	21,900	4,314	112,500	17,775			28,165
Total: 1949	394,490,000	77,714,530	106,144,000	16,770,752	81,340,000	10,086,160	121,649,828
1948	464,014,000	98,521,038	111,900,000	20,030,100	82,980,000	11,036,340	149,763,677

MINING INDUSTRY

The declines in the production of ore (15 percent) and in all five metals in Utah in 1949 were attributable to two main factors: The labor strike at the Utah Copper mine, beginning in October 1948 and in effect until February 7, 1949, and the sharp drop in base-metal prices, beginning in March and continuing well into summer. Unstable markets for base metals not only resulted in closing a number of mines but in curtailing production at others through cutbacks in labor force or through a reduction of the workweek from 48 to 40 hours. Of the 10 leading State producers in point of tonnage, only the Chief Consolidated Mining Co. property, Butterfield group, United States & Lark group, and Daly No. 1 dump reported more ore sold or treated in 1949 than in 1948, whereas declines were pronounced at the Utah Copper mine, Calumet mine, and properties of the Park Utah Consolidated Mines Co., Silver King Coalition Mines Co., New Park Mining Co., and Pacific Bridge Co.

Active lode mines in the State dropped 21 percent from 118 in 1948 to 93 in 1949; the number of active placers (2) was unchanged.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Utah in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold ore	5	4,726	1,531	4,509	34,595	51,793	3,792
Dry gold-silver ore	16	93,035	5,541	260,093	585,096	2,937,414	2,113
Dry silver ore	19	73,874	1,576	398,558	203,620	1,701,556	----------
	40	171,635	8,648	663,160	823,311	4,690,763	5,905
Copper	13	20,924,274	267,891	2,233,708	[1] 390,243,978	32,075	----------
Lead	39	20,304	907	114,120	60,759	2,853,437	155,700
Zinc	3	[2] 33,705	88	12,061	106,632	514,590	2,167,606
Zinc-lead	38	842,441	36,442	3,677,733	3,195,053	97,861,774	78,833,330
Zinc-lead-copper	3	1,108	70	24,098	60,267	191,361	177,459
Total lode mines	[3] 93	21,993,467	314,046	6,724,880	[1] 394,490,000	106,144,000	81,340,000
Placers	2	----------	12	----------	----------	----------	----------
Total: 1949	95	21,993,467	314,058	6,724,880	[1] 394,490,000	106,144,000	81,340,000
1948	120	25,741,911	368,422	8,045,329	[4] 454,014,000	111,900,000	82,980,000

[1] Includes 15,822,418 pounds recovered from mine-water precipitates.
[2] Includes 17,480 tons of zinc slag.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[4] Includes 15,658,743 pounds recovered from mine-water precipitates.

METALLURGIC INDUSTRY

The 21,993,467 tons of ore produced in Utah in 1949 were treated as follows: 21,811,661 tons (99 percent) at mills (25,517,522 tons in 1948); 164,326 tons (less than 1 percent) shipped crude to smelters (189,571 tons in 1948); and 17,480 tons of old slag fumed (34,818 tons in 1948).

The 10 mills active in Utah in 1949 treated Utah ore and tailings as follows: Three plants (Arthur, Magna, and Prosper), 20,922,420 tons of copper ore; six mills (Bauer, Midvale, Pacific Bridge, Silver King, Tooele, and Horn Silver), 849,241 tons of zinc-lead ore and old tailings, zinc-lead-copper ore, and lead ore; one plant (Bauer), 24,000 tons of old pyritic gold-silver tailings; and one flotation mill in Summit County, 16,000 tons of current zinc tailings.

The Midvale 1,700-ton concentrator of the United States Smelting Refining & Mining Co. operated all year and continued to treat largely zinc-lead ore, most of which came from company-owned properties in the West Mountain (Bingham) district and from the property of the New Park Mining Co. in the Park City region. The 1,500-ton concentrator of the International Smelting & Refining Co. at Tooele operated mainly on zinc-lead ore supplied by Chief Consolidated Mining Co. in the Tintic district and the Park Utah Consolidated Mines Co. in the Park City region; the copper unit at the concentrator remained idle. The 700-ton concentrator of the Combined Metals Reduction Co. at Bauer operated throughout 1949, largely on zinc-lead ore supplied by company owned or operated mines in Utah and Idaho and by the Chief Consolidated Mining Co. The 800-ton

concentrator of the Silver King Coalition Mines Co. at Park City operated until the company mine closed on July 1; only company zinc-lead ore was treated. The tailing plant of the Pacific Bridge Co. at Park City closed on May 6, following a sharp decline in the prices of lead and zinc.

The Garfield copper smelter of the American Smelting & Refining Co. reopened shortly after the Utah Copper mine returned to production on February 7 and operated during the remainder of 1949. The Murray lead smelter of the American Smelting & Refining Co. closed indefinitely in October because of an inadequate supply of ores and concentrates. The Midvale lead smelter of the United States Smelting, Refining & Mining Co. operated all year and treated lead concentrates, lead ores, and gold and silver ores, chiefly from company-owned properties in Utah. The Tooele lead plant of the International Smelting & Refining Co. operated all year in conjunction with the company zinc slag-fuming plant and treated zinc-lead ores, lead ores and concentrates, and zinc ores and old slag from both company and custom sources. The slag-fuming plant treated a total of 107,774 tons of current hot slag, old cold slag, and crude ore in 1949, compared with 127,550 tons in 1948; output in 1949 was 18,622 tons of zinc fume, averaging 76.23 percent zinc, and 2,757 tons of lead fume, averaging 47.76 percent lead. The company copper smelter at Tooele remained idle all of 1949.

Work was pushed rapidly on construction of the $16,000,000 copper refinery of the Kennecott Copper Corp. and the copper-anode plant of the American Smelting & Refining Co., both at Garfield.

Mine production of metals in Utah in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Concentrates smelted	305,047	5,894,423	377,134,931	96,895,957	77,884,012
Ore smelted [1]	8,999	830,457	1,532,651	9,248,043	3,455,988
Mine-water precipitates smelted [2]	-------	-------	15,822,418	-------	-------
Total lode	314,046	6,724,880	394,490,000	106,144,000	81,340,000
Placer	12	-------	-------	-------	-------
Total: 1949	314,058	6,724,880	394,490,000	106,144,000	81,340,000
1948	368,422	8,045,329	454,014,000	111,900,000	82,980,000

[1] Includes 17,480 tons of old slag.
[2] All from Salt Lake County.

Gross metal content of Utah ore treated at mills in 1949, by classes of ore [1]

Class of ore	Ore (short tons)	Gross metal content of mill feed				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold-silver ore	24,000	1,075	32,000	-------	515,000	-------
Copper	20,922,420	374,143	2,622,308	410,663,870	-------	-------
Lead	10,693	252	9,160	4,000	287,700	25,000
Zinc	16,000	25	6,000	3,000	50,000	150,000
Zinc-lead	837,759	45,228	4,329,723	4,724,990	109,058,425	101,850,958
Zinc-lead-copper	789	70	22,128	53,210	99,164	132,930
Total: 1949	21,811,661	420,793	7,021,319	415,449,070	110,010,289	102,158,888
1948	25,517,522	494,004	8,494,949	480,206,373	116,504,748	108,705,778

[1] Exclusive of copper ore treated by leaching.

Gross metal content of concentrates produced from ores mined in Utah in 1949, by classes of concentrates smelted

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Copper	576, 208	267, 724	2, 214, 956	38[illegible] 592, 042	----------	----------
Lead	82, 533	16, 956	2, 627, 446	4, 055, 033	85, 982, 422	9, 280, 407
Lead-copper	71	26	12, 960	23, 140	77, 958	12, 370
Zinc	74, 497	6, 785	629, 409	1, 160, 512	8, 914, 639	77, 403, 558
Iron (from gold-silver, zinc-lead, zinc-lead-copper ore)	93, 910	13, 574	419, 407	653, 216	6, 124, 935	5, 102, 387
Total: 1949	827, 219	305, 065	5, 904, 178	385, 483, 943	101, 099, 954	91, 807, 722
1948	929, 030	351, 063	6, 972, 286	445, 456, 305	102, 551, 278	92, 003, 497

Mine production of metals from mills [1] in Utah in 1949, in terms of recoverable metals

	Ore milled (short tons)	Concentrates smelted and recoverable metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES							
Beaver	11, 309	714	190	10, 368	17, 664	272, 461	58, 200
Juab	111, 130	27, 634	1, 046	603, 026	77, 611	10, 187, 367	11, 564, 393
Salt Lake	21, 354, 204	731, 840	283, 403	4, 165, 361	376, 134, 381	63, 166, 440	44, 770, 872
Summit	198, 144	22, 871	2, 850	467, 761	220, 360	10, 770, 796	10, 336, 638
Tooele	66, 849	24, 010	1, 833	289, 077	144, 170	6, 861, 008	4, 165, 647
Utah	5, 287	1, 594	184	27, 300	13, 213	579, 921	620, 336
Wasatch	64, 738	18, 556	15, 541	331, 530	527, 532	5, 057, 964	6, 367, 926
Total: 1949	21, 811, 661	827, 219	305, 047	5, 894, 423	377, 134, 931	96, 895, 957	77, 884, 012
1948	25, 517, 522	929, 030	351, 029	6, 953, 487	435, 809, 613	98, 128, 283	77, 392, 987
BY CLASSES OF CONCENTRATES SMELTED							
Copper		576, 208	267, 724	2, 214, 956	373, 960, 201	----------	----------
Lead		82, 533	16, 956	2, 627, 446	1, 567, 205	83, 092, 924	2, 017, 956
Lead-copper		71	26	12, 960	17, 355	74, 820	----------
Zinc		74, 497	6, 767	619, 654	1, 097, 694	8, 418, 025	75, 564, 228
Iron (from gold-silver, zinc-lead, and zinc-lead-copper ore)		93, 910	13, 574	419, 407	492, 476	5, 310, 188	301, 828
Total 1949		827, 219	305, 047	5, 894, 423	377, 134, 931	96, 895, 957	77, 884, 012

[1] No bullion produced in 1949.

Gross metal content of Utah crude ore shipped to smelters in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	4, 726	1, 551	4, 509	35, 723	80, 848	5, 238
Dry gold-silver	69, 035	4, 845	240, 909	596, 863	4, 658, 025	2, 919
Dry silver	73, 874	1, 576	398, 558	211, 471	2, 613, 426	214, 389
Copper	1, 854	167	18, 752	474, 772	51, 255	----------
Lead	9, 611	724	106, 762	82, 587	2, 728, 277	607, 158
Zinc [1]	17, 705	88	11, 652	129, 983	520, 517	2, 884, 888
Zinc-lead	4, 682	62	45, 078	69, 495	1, 446, 226	1, 555, 374
Zinc-lead-copper	319	10	4, 628	28, 179	103, 422	102, 391
Total: 1949	181, 806	9, 003	830, 848	1, 629, 073	12, 201, 991	5, 372, 357
1948	224, 389	17, 394	1, 093, 334	2, 730, 612	17, 388, 864	7, 874, 728

[1] Includes 17,480 tons of old slag.

Mine production of metals from Utah crude ore shipped to smelters in 1949, in terms of recoverable metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Beaver	458	25	1,512	34,336	30,039	2,300
Box Elder	44	1	264	100	12,500	
Juab	26,641	1,158	169,838	108,889	2,268,133	301,907
Millard	36		52	500	5,200	
Piute	1,281	182	17,367	8,000	51,000	
Salt Lake	56,791	2,877	189,079	304,201	3,400,860	769,128
San Juan	6			500		
Summit	55,090	1,040	259,636	132,640	1,327,504	9,862
Tooele	21,875	936	60,425	570,330	1,538,992	2,347,553
Uintah	3		10		200	200
Utah	18,505	2,763	122,779	329,287	490,579	20,664
Wasatch	369	12	2,975	21,968	10,536	4,374
Washington	707	5	6,520	21,900	112,500	
Total: 1949	181,806	8,999	830,457	1,532,651	9,248,043	3,455,988
1948	224,389	17,379	1,091,835	2,545,644	13,771,717	5,587,013
BY CLASSES OF ORE						
Dry gold	4,726	1,531	4,509	34,595	51,793	3,792
Dry gold-silver	69,035	4,845	240,909	585,096	2,799,414	2,113
Dry silver	73,874	1,576	398,558	203,620	1,701,556	
Copper	1,854	167	18,752	461,359	32,075	
Lead	9,611	724	106,762	58,884	2,633,292	155,700
Zinc [1]	17,705	84	11,261	106,032	506,690	2,093,114
Zinc-lead	4,682	62	45,078	59,063	1,421,602	1,127,160
Zinc-lead-copper	319	10	4,828	24,002	101,621	74,109
Total	181,806	8,999	830,457	1,532,651	9,248,043	3,455,988

[1] Includes 17,480 tons of old slag.

REVIEW BY COUNTIES AND DISTRICTS

BEAVER COUNTY

Beaver Lake District.—Penn-Utah Mining Co. operated the O. K. mine from May to December 1949 and shipped 158 tons of copper smelting ore containing 4 ounces of gold, 251 ounces of silver, and 34,099 pounds of copper.

Granite District.—District production comprised 13 tons of zinc-lead ore from the Beaver View group and 6 tons of silver ore from the Lucky Lu group.

San Francisco District.—Metal Producers, Inc., worked the Horn Silver mine under lease from January to August and again through December; the company 500-ton gravity-flotation mill was operated from about the middle of April to the middle of June. Mine production was 10,643 tons of lead milling ore containing 250 ounces of gold, 9,000 ounces of silver, 4,000 pounds of copper, 280,000 pounds of lead, and 25,000 pounds of zinc; and 35 tons of zinc-lead milling ore containing 1 ounce of gold, 158 ounces of silver, 126 pounds of copper, 5,229 pounds of lead, and 7,019 pounds of zinc. Remaining district output was 126 tons of zinc-lead milling ore from the Frisco Silver-Lead mine.

Star and North Star District.—James D. Williams, lessee, operated the Harrington-Hickory mine until May 15, then closed the mine because of low prices for lead and zinc. Production was 152 tons of

Mine production of gold, silver, copper, lead, and zinc in Utah in 1949, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer							
Beaver County:									
Beaver Lake	1		278	8	410	44,500			$9,417
Bradshaw	2		54	1	147		6,500		1,195
Granite	2		19	1	53		2,800	2,300	810
San Francisco	2		10,804	185	7,657	6,500	239,200	13,400	54,142
Star and North Star	5		612	20	3,613	1,000	54,000	44,800	18,254
Box Elder County: Lucin	2		44	1	264	100	12,500		2,269
Grand County: Colorado River		1		11					385
Juab County:									
Fish Springs	1		4		610		3,500	200	1,130
Mount Nebo (Mona)	1		41		42		10,500		1,697
Spring Creek (Deep Creek)	1		2	8	222	100	100		517
Tintic [1]	8		137,719	2,196	771,990	186,400	12,440,400	11,865,500	4,249,175
West Tintic	1		5				1,000	600	232
Millard County:									
Detroit (Drum Mountain)	1		1			400			79
Gordon (Dog Valley)	1		35		52	100	5,200		889
House Mountains		1		1					35
Piute County:									
Mount Baldy	1		836	93	15,081	7,000	46,500		25,630
Ohio	3		445	89	2,286	1,000	4,500		6,092
Salt Lake County:									
Big Cottonwood	2		3,707	31	21,549	43,000	1,076,500	837,800	303,033
Little Cottonwood	6		1,089	67	13,680	13,000	207,500	14,000	51,808
Smelter	(2)		710	27	2,833	4,000	84,000	67,000	25,877
West Mountain (Bingham)	5		21,405,489	286,155	4,316,378	392,201,000	65,199,300	44,621,200	107,020,080
San Juan County: La Sal	1		6			500			99
Summit County: Uintah	7		253,234	3,890	727,397	353,000	12,098,300	10,346,500	4,058,519
Tooele County:									
Blue Bell	1		80	2	1,980	100	58,400		11,109
Clifton	1		4		42		600	100	145
Dugway	2		194	1	336	100	38,300	44,500	11,928
Erickson	2		772	1	506	800	105,400	85,500	27,906
Ophir	7		10,866	158	96,746	250,500	2,195,700	2,007,500	738,289
Rush Valley [3]	7		76,405	1,972	247,480	462,000	5,905,500	4,375,300	1,859,622
Willow Springs	1		403	635	2,412	1,000	96,100	300	39,826
Uintah County: Brush Creek	1		3		10		200	200	66
Utah County:									
American Fork	4		1,058	10	7,919	3,000	158,200	343,200	75,661
North Tintic	1		5				1,500		237
Tintic [1]	7		22,729	2,937	142,160	339,500	910,800	297,800	479,171
Wasatch County:									
Blue Ledge	1		64,759	15,541	331,566	528,000	5,062,700	6,372,300	2,538,107
Snake Creek	2		348	12	2,939	21,500	5,800		8,232
Washington County:									
Harrisburg (Leeds)	1		240	2	2,328	11,000			4,344
Tutsagubet	2		467	3	4,192	10,900	112,500		23,821
Total Utah	93	2	21,993,467	814,058	6,724,880	394,490,000	106,144,000	81,340,000	121,649,828

[1] Tintic district is in both Juab and Utah Counties. [2] Production from yard cleanings; property not counted as mine. [3] Includes production from Smelter district; Bureau of Mines not at liberty to publish separate figures.

gold-silver smelting ore containing 18 ounces of gold, 512 ounces of silver, 625 pounds of copper, and 3,585 pounds of lead; and 335 tons of zinc-lead milling ore containing 3 ounces of gold, 2,842 ounces of silver, 31,935 pounds of lead, and 57,772 pounds of zinc. J. C. Hanley, lessee, worked the Rebel mine for 1 month in 1949 and shipped 65 tons of lead smelting ore containing 1 ounce of gold, 327 ounces of silver, 104 pounds of copper, and 15,627 pounds of lead. Remaining district production was 38 tons of lead ore from the Wild Bill claim, 6 tons of similar ore from the Florence claim, and 16 tons of silver ore from the Last Chance claim.

BOX ELDER COUNTY

Lucin District.—I. M. Westover, lessee, worked the Copper Mountain (Salt Lake Copper) group from June through October and shipped 37 tons of lead smelting ore containing 1 ounce of gold, 261 ounces of silver, 168 pounds of copper, and 8,265 pounds of lead. Other district production was 7 tons of lead smelting ore from the property of the Utah Metal Mines.

JUAB COUNTY

Mount Nebo (Mona) District.—Staheli & Loveless worked the Vagabond group and shipped 41 tons of lead smelting ore containing 42 ounces of silver, 11,067 pounds of lead, and 800 pounds of zinc.

Tintic District.—The Tintic district, lying in both Juab and Utah Counties, is reviewed here. The following table gives metal production in each section of the district in 1949, a comparison with the total in 1948, and the grand total from 1869 to 1949.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Juab and Utah counties, Utah, 1948–49, and total, 1869–1949, in terms of recoverable metals

	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1949								
Juab County	8	137,719	2,196	771,990	186,400	12,440,400	11,865,500	$4,249,175
Utah County	7	22,729	2,937	142,160	339,500	910,800	297,800	479,171
Total: 1949	15	160,448	5,133	914,150	525,900	13,351,200	12,163,300	4,728,346
1948	21	175,897	11,007	1,123,460	1,002,800	11,939,400	7,360,200	4,735,701
Total 1869–1949	--------	[1] 15,382,390	2,619,898	262,930,065	245,373,864	1,901,481,679	96,456,438	407,470,997

[1] Figures estimated for certain years before 1901.

Chief Consolidated Mining Co. operated its Chief No. 1, Gemini, and Eureka Hill mines throughout 1949 and exceeded its 1948 tonnage by 5 percent. Output from the mines comprised 111,177 tons of zinc-lead ore containing 2,053 ounces of gold, 716,423 ounces of silver, 109,328 pounds of copper, 11,438,332 pounds of lead, and 14,874,730 pounds of zinc; 10,832 tons of silver ore containing 218 ounces of gold, 59,227 ounces of silver, 20,537 pounds of copper, and 740,490 pounds of lead; and 2,147 tons of lead ore containing 41 ounces of gold, 34,980 ounces of silver, 2,467 pounds of copper, 621,911 pounds of lead, and 121,700 pounds of zinc.

Other producing properties in the Juab County part of the district included the Dragon & Martha Washington group (gold-silver ore), Godiva mine (silver, lead, and zinc-lead ores), Mammoth mine (gold-silver ore), Park-Kingsley group (silver ore), Centennial-Beck-Victoria group (gold-silver, silver, lead, and zinc-lead ores), Eagle-Blue Bell mine (lead and gold-silver ores), and the Empire group (silver ore).

In the Utah County part of the district, the Eureka Lilly mine was the leading producer, but the mine was active only from March through June. Output was 5,936 tons of gold ore, 2,583 tons of gold-silver ore, and 213 tons of zinc-lead ore. The Tintic Standard mine of the Tintic Standard Mining Co. likewise was operated only from March through June. Production was 2,993 tons of silver smelting ore containing 72 ounces of gold, 43,025 ounces of silver, 16,940 pounds of copper, and 275,396 pounds of lead; and 1,163 tons of zinc-lead milling ore containing 33 ounces of gold, 11,454 ounces of silver, 3,292 pounds of copper, 241,794 pounds of lead, and 99,893 pounds of zinc. The company also operated the Harold dump from July through December and shipped 2,288 tons of old gold-silver mill tailings.

Remaining production from the area included zinc-lead ore and gold-silver ore from the Mountain View group, the North Lily group, and the Yankee group, and zinc-lead ore and gold ore from the Tintic Bullion group. The North Lily and Tintic Bullion groups closed at the end of June.

PIUTE COUNTY

Mount Baldy District.—Patrick T. Henry Corp. operated the Deep Tunnel group and shipped 836 tons of silver smelting ore.

Ohio District.—Principal production was 438 tons of gold-silver smelting ore from the Copper Belt Extension Tunnel property operated by the Patrick T. Henry Corp.

SALT LAKE COUNTY

Big Cottonwood District.—The Cardiff mine was the main producer, shipping 3,157 tons of zinc-lead ore containing 28 ounces of gold, 19,531 ounces of silver, 42,621 pounds of copper, 1,007,542 pounds of lead, and 974,267 pounds of zinc; 316 tons of lead ore containing 5 ounces of gold, 2,600 ounces of silver, 14,686 pounds of copper, 102,189 pounds of lead, and 11,031 pounds of zinc; and 225 tons of zinc ore containing 192 ounces of silver, 303 pounds of copper, 11,312 pounds of lead, and 172,983 pounds of zinc.

Little Cottonwood District.—Test shipments were made in 1949 from four separate parts of the South Hecla mine comprising 327 tons of lead ore containing 11 ounces of gold, 3,994 ounces of silver, 2,001 pounds of copper, 66,055 pounds of lead, and 62,952 pounds of zinc; 16 tons of zinc-lead ore containing 164 ounces of silver, 181 pounds of copper, 1,664 pounds of lead, and 1,581 pounds of zinc; and 7 tons of copper ore containing 85 ounces of silver, 361 pounds of copper, and 164 pounds of lead. Other district production was mainly 395 tons of lead ore from the Michigan-Utah waste dump; 88 tons of similar ore from the Flagstaff claim; 173 tons of lead ore, 35 tons of

zinc-lead ore, and 29 tons of copper ore from the Columbus-Rexall group; and 17 tons of silver ore from the Peruvian Consolidated group.

Smelter District.—Yard cleanings were the source of metal credited to the Smelter district in 1949.

West Mountain (Bingham) District.—In 1949 the West Mountain (Bingham) district produced 91 percent of the State gold, 64 percent of the silver, 99 percent of the copper, 61 percent of the lead, and 55 percent of the zinc; total value of the five metals represented 88 percent of the State total value.

Mine production of gold, silver, copper, lead, and zinc in West Mountain (Bingham) district, Salt Lake County, Utah, 1948–49, and total, 1865–1949, in terms of recoverable metals

Year	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1948	6	24,889,134	332,588	4,694,674	450,450,800	61,343,900	44,153,300	$130,490,268
1949	5	21,405,489	286,155	4,316,378	392,201,000	65,199,300	44,621,200	107,020,080
Total 1865–1949		[1] 598,904,991	6,847,186	156,952,186	[2] 5,355,961	[2] 1,651,464	[2] 544,531	2,181,245,979

[1] Figures estimated for certain years before 1901.
[2] Short tons.

Output of copper ore at the Utah Copper mine of the Kennecott Copper Corp. was about 14 percent less in 1949 than in 1948, owing to the previously mentioned work stoppage at the beginning of the year and the shorter workweek during much of the period of operation. Following settlement of the labor strike on February 7, the Magna and Arthur mills returned to operation and maintained a schedule of 6 days per week and three shifts per day for the remainder of the year. The company leaching plant at the mouth of Bingham Canyon recovered several million pounds of cement copper during the year from waste dumps.

Lead production increased over 5 percent at the United States & Lark property of the United States Smelting, Refining & Mining Co., and copper nearly 13 percent; gold output declined 11 percent, silver 2, and zinc less than 1 percent; and ore production gained 9 percent.

Combined Metals Reduction Co. and lessees operated the Butterfield group throughout the year and increased the ore output from 31,149 tons in 1948 to 38,300 tons in 1949. Yields of silver, lead, and zinc were considerably greater than in 1948, but yield of recoverable gold declined slightly. The 38,300 tons produced—all zinc-lead ore—contained 2,222 ounces of gold, 329,205 ounces of silver, 7,216,580 pounds of lead, and 3,011,860 pounds of zinc.

The Columbia group of the Ohio Copper Co. was operated by the company and lessees throughout 1949. Production was 4,145 tons of zinc-lead milling ore containing 357 ounces of gold, 12,958 ounces of silver, 45,560 pounds of copper, 380,056 pounds of lead, and 254,795 pounds of zinc.

Remaining district production was 690 tons of zinc-lead milling ore and 250 tons of lead smelting ore from the Apex-Delaware group.

SUMMIT AND WASATCH COUNTIES

Park City Region

The Park City region includes the Uintah district in Summit County and the Blue Ledge and Snake Creek districts in Wasatch County. The following table shows the production and total value of the five metals in 1949 compared with 1948 and the total from 1870 to 1949.

Mine production of gold, silver, copper, lead, and zinc in Park City region, Summit and Wasatch Counties, Utah, 1948–49, and total, 1870–1949, in terms of recoverable metals

Year	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1948	10	506,671	19,087	1,703,864	1,193,300	25,339,400	20,639,700	$9,749,907
1949	10	318,341	19,443	1,061,902	902,500	17,166,800	16,718,800	6,604,858
Total 1870–1949		[1]15,867,508	617,388	238,893,214	71,873,013	2,472,923,634	745,082,011	391,415,085

[1] Figures estimated for certain years before 1901.

The drop in base-metal prices forced the Silver King Coalition Mines Co. to close its property at the end of June. During its period of operation the 800-ton company flotation mill treated 23,112 tons of zinc-lead ore compared with 50,892 tons in 1948. The ore in 1949 contained 505 ounces of gold, 194,760 ounces of silver, 104,877 pounds of copper, 3,976,743 pounds of lead, and 1,800,000 pounds of zinc. In addition, 452 tons of lead ore were shipped direct to a smelter.

New Park Mining Co. closed its property on June 30, 1949, owing to weak base-metal prices, then reopened at the middle of September. Production for the year was 64,738 tons of zinc-lead milling ore (72,831 tons in 1948) and 21 tons of similar ore shipped to a smelter. The milling ore contained 18,486 ounces of gold, 376,504 ounces of silver, 772,835 pounds of copper, 5,586,531 pounds of lead, and 8,153,542 pounds of zinc.

Park Utah Consolidated Mines Co. operated its property throughout 1949 but on a greatly reduced basis after June 27, following sharp declines in the prices of lead and zinc. Ore output for the year was 39,410 tons compared with 44,753 tons in 1948. The ore in 1949 contained 3,086 ounces of gold, 260,688 ounces of silver, 123,178 pounds of copper, 7,068,451 pounds of lead, and 8,878,091 pounds of zinc.

Pacific Bridge Co. closed its 1,000-ton flotation mill on May 6, because of the slump in prices of lead and zinc. During its 1949 period of operation, the mill treated 119,773 tons of old zinc-lead tailings from the Grasselli dump, compared with 292,358 tons in 1948. Concentrates comprised 2,800 tons of lead concentrate containing 100 ounces of gold, 31,000 ounces of silver, 27,000 pounds of copper, 800,000 pounds of lead, and 240,000 pounds of zinc; and 1,806 tons of zinc concentrate containing 65 ounces of gold, 36,000 ounces of silver, 25,000 pounds of copper, 215,000 pounds of lead, and 1,800,000 pounds of zinc. In addition, 1,847 tons of old silver tailings were shipped direct to a smelter after the mill closed.

McFarland & Hullinger, lessees, operated the Daly No. 1 waste dump and shipped 50,951 tons of siliceous silver ore to a smelter. The West Park Mining Co. operated its property from June to October and shipped 255 tons of copper smelting ore containing 10 ounces of gold, 176 ounces of silver, and 21,182 pounds of copper. Silver King Western mine was operated by lessees from May to December. Output of ore, all shipped to smelters, comprised 1,530 tons of lead ore and 40 tons of silver ore. Reuben Garbett re-treated a substantial tonnage of current zinc tailings from the Silver King Coalition mill until the mill closed at the end of June. Remaining district production was 93 tons of silver smelting ore from the J. I. C. & West Quincy (New Quincy) property and 119 tons of lead ore from the Crescent mine dump.

TOOELE COUNTY

Blue Bell District.—Output was 80 tons of lead smelting ore from the Blackhawk claim.

Dugway District.—Production comprised 163 tons of zinc-lead milling ore from the Smelter Canyon & Four Metals group and 31 tons of lead smelting ore from the Dugway claim.

Erickson District.—The Desert Exploration Co. operated the Ida-Desert View group from March 1 to December 20 and shipped 246 tons of zinc-lead ore and 79 tons of lead ore. The Bar X Mining Co. worked the Esther group and shipped 447 tons of zinc-lead milling ore.

Ophir District.—McFarland & Hullinger operated the Hidden Treasure mine under lease and shipped 5,519 tons of zinc-lead ore, 480 tons of lead ore, and 265 tons of zinc-lead-copper ore. C. S. Lynch, lessee, conducted development throughout 1949 at the Mecca mine and shipped 229 tons of lead smelting ore containing 3 ounces of gold, 3,155 ounces of silver, 2,366 pounds of copper, 82,210 pounds of lead, and 23,370 pounds of zinc. Lessees operated the Mono-Kearsarge group and shipped 657 tons of zinc-lead-copper ore and 232 tons of copper ore. Lessees worked the Shoo Fly group and shipped 186 tons of zinc-lead-copper milling ore containing 15 ounces of gold, 5,128 ounces of silver, 9,610 pounds of copper, 19,764 pounds of lead, and 24,930 pounds of zinc. The Ophir Hill mine was operated until May 16 by the Ophir Development Co. and was then leased to the United States Smelting, Refining & Mining Co.; several thousand tons of zinc-lead milling ore were shipped. The Ophir unit of the United States Smelting, Refining & Mining Co. produced several cars of copper smelting ore.

Rush Valley District.—Ore production at the West Calumet (Calumet) mine of the Combined Metals Reduction Co. dropped from 38,396 tons in 1948 to 32,807 tons in 1949. All the ore in 1949 was zinc-lead milling ore and contained 2,093 ounces of gold, 238,817 ounces of silver, 6,009,860 pounds of lead, and 2,920,100 pounds of zinc. The company Honorine-Galena King group had a production of 816 tons of zinc-lead milling ore and 11 tons of lead smelting ore; and the Cyclone-Tip Top-Southport (Bluestone) group, 239 tons of lead smelting ore. The company flotation mill at Bauer treated 24,000 tons of pyritic gold-silver tailings, which yielded 7,643 tons of iron concentrate valuable chiefly for its gold and silver. Other dis-

trict production was 213 tons of zinc-lead milling ore and 80 tons of lead smelting ore from the Silver Eagle group and 52 tons of old silver tailings from the Bullion Lead property.

Smelter District.—Output credited to producers in the Smelter district comprised the metals recovered from 707 tons of old smelter cleanings from the plant of the International Smelting & Refining Co. at Tooele and 17,480 tons of old zinc slag treated at the company slag-fuming plant.

Willow Springs District.—Lessees operated the Oro Del Rey group from April 1 to December 20 and shipped to smelters 251 tons of lead ore containing 427 ounces of gold, 1,909 ounces of silver, 650 pounds of copper, 90,011 pounds of lead, and 3,075 pounds of zinc; and 152 tons of gold ore containing 208 ounces of gold, 503 ounces of silver, 501 pounds of copper, and 15,924 pounds of lead.

UTAH COUNTY

American Fork District.—Dutchman Mine Leasers operated the Dutchman group until October 1949, then closed because of economic conditions. Production during the year was 994 tons of zinc-lead milling ore containing 12 ounces of gold, 8,519 ounces of silver, 4,118 pounds of copper, 166,419 pounds of lead, and 430,501 pounds of zinc. Remaining district production was mainly 48 tons of zinc-lead milling ore from the Floral Lode claim.

Tintic District.—Mines in the Utah County section of the Tintic district are reviewed under Juab County.

WASHINGTON COUNTY

Harrisburg (Leeds) District.—F. S. Leany operated the Requa mine and shipped 240 tons of copper smelting ore.

Tutsagubet District.—E. L. Cox worked the Dixie (Apex) mine from January to May 15 and shipped to smelters 400 tons of lead ore containing 3 ounces of gold, 4,138 ounces of silver, 3,492 pounds of copper, and 102,022 pounds of lead; and 29 tons of copper ore containing 7 ounces of silver, and 7,822 pounds of copper. Wayne Snow, lessee, shipped 38 tons of lead ore from the Black Warrior claim.

Washington

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. Needham and Paul Luff

GENERAL SUMMARY

OF THE production of gold, silver, copper, lead, and zinc in Washington in 1949, only gold rose (3 percent) above the 1948 levels. Silver output declined 5 percent, copper 7, lead 10, and zinc 15 percent. These decreases, coupled with lower average prices for base metals, reduced the total value of the five metals 14 percent, from $11,171,715 in 1948 to $9,613,307 in 1949. The value of gold increased nearly 3 percent, but that of silver declined almost 5 percent, copper 15, lead 21, and zinc 21 percent. Of the total value in 1949, zinc contributed 28 percent, gold 26, copper 22, lead 21, and silver 3 percent.

Chelan County remained in first place among Washington counties in 1949 in both tonnage of ore treated and value of metals produced. Pend Oreille County held second position in both respects.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.

[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc, in Washington, 1945–49, and total, 1860–1949, in terms of recoverable metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945	21	3	968,246	57,860	$2,025,100	281,444	$200,138
1946	16	5	858,023	51,168	1,790,880	264,453	213,678
1947	25	6	676,176	34,965	1,223,775	293,736	265,831
1948	30	1	974,257	70,075	2,452,625	375,831	340,146
1949	29	3	1,012,198	71,994	2,519,790	357,853	323,875
1860–1949			(1)	2,355,704	61,204,963	13,857,293	10,039,365

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945	5,821	$1,571,670	3,802	$653,944	11,693	$2,689,390	$7,140,242
1946	4,527	1,466,748	2,987	651,166	11,329	2,764,276	6,886,748
1947	2,240	940,800	5,359	1,543,392	13,800	3,339,600	7,313,398
1948	5,665	2,458,610	7,147	2,558,626	12,638	3,361,708	11,171,715
1949	5,275	2,078,350	6,417	2,027,772	10,740	2,663,520	9,613,307
1860–1949	92,106	26,178,269	94,686	16,276,814	174,993	31,743,476	145,442,887

[1] 1860–1903: Figures not available; 1904–49, 15,188,053 tons produced.

Mine production of gold, silver, copper, lead, and zinc in Washington in 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	5,975	31,643	465	495	810
February	5,935	35,165	460	385	710
March	6,770	35,675	480	550	810
April	7,075	39,445	485	545	830
May	6,240	38,050	435	467	825
June	6,245	33,255	475	460	950
July	4,312	23,990	365	390	547
August	5,355	25,515	450	410	620
September	4,895	20,405	385	240	748
October	4,885	21,840	350	695	1,505
November	6,545	24,305	465	895	1,265
December	7,762	28,565	460	885	1,120
Total: 1949	71,994	357,853	5,275	6,417	10,740
1948	70,075	375,831	5,665	7,147	12,638

Gold.—The increase of 1,919 ounces in Washington's gold output in 1949 resulted mainly from substantial shipments of gold ore during the second half of the year from the Gold King mine near Wenatchee. The Holden mine in Chelan County was the State's leading gold producer, followed in order by the Knob Hill mine in Ferry County, the Gold King mine in Chelan County, and the Aurum group in Ferry County. Yield of the metal increased slightly at the Holden mine but declined at the Knob Hill mine and the Aurum group. The above four properties contributed all but a small quantity of the State gold in 1949. Placer production was small and came from three producers, compared with one in 1948. Of the State gold in 1949, almost 60 percent was recovered from zinc-copper ore and most of the remainder from gold ore.

Gold produced at placer mines in Washington, 1945–49, by classes of mines and by methods of recovery

Class and method	Mines producing	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average per cubic yard
Dragline dredges:					
1945					
1946	1	10,000	85	$2,975	$0.298
1947	1	3,500	14	490	.140
1948–49					
Nonfloating washing plants: [1]					
1945					
1946	1	15,000	11	385	.026
1947	3	4,700	56	1,960	.417
1948	1	2,900	10	350	.121
1949					
Small-scale hand methods:					
1945	3	275	14	490	1.782
1946	3	115	5	175	1.522
1947	2	400	7	245	.613
1948					
1949	3	400	10	350	.875
Grand total placers:					
1945	3	275	14	490	1.782
1946	5	25,115	101	3,535	.141
1947	6	8,600	77	2,695	.313
1948	1	2,900	10	350	121
1949	3	400	10	350	.875

[1] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."

Silver.—Among the four leading State silver producers in 1949, only the Bonanza mine in Stevens County reported an increase. The Knob Hill mine (gold ore) remained in first place by a slight margin, followed by the Holden mine (zinc-copper ore), the Bonanza mine (lead ore), and the Aurum group (gold ore). These four furnished 89 percent of the State silver. Gold ore supplied 44 percent of the State silver in 1949, followed by zinc-copper ore with about 37 percent; most of the remainder came from lead and zinc-lead ores.

Copper.—The decline in State yield of copper in 1949 resulted from a drop of about 7 percent in output of the metal at the Holden mine in Chelan County. No other properties in the State contributed important quantities of copper.

Lead.—The main factor in reducing Washington's output of lead in 1949 was the continuation of the labor strike until September at the Grandview mine of the American Zinc, Lead & Smelting Co. in Pend Oreille County. As a result, lead output from this property in 1949 was only 54 percent of that in 1948. Production of the metal also declined at the Deep Creek mine in Stevens County, but substantial increases were reported from the property of the Pend Oreille Mines & Metals Co. in Pend Oreille County and the Bonanza mine in Stevens County. The above four properties supplied 97 percent of the State lead in 1949. Of the total lead, 64 percent was derived from zinc-lead ore and nearly all the remainder from lead ore.

Zinc.—The work stoppage at the Grandview mine had the same effect on State production of zinc in 1949 as it did on lead. Output of the metal also declined at the Holden and Deep Creek mines but rose markedly at the property of the Pend Oreille Mines & Metals Co. The Metaline Mining & Leasing Co. returned to production at

its property in Pend Oreille County in September when ore-treatment facilities again became available at the Grandview mill of the American Zinc, Lead & Smelting Co. The property of the Pend Oreille Mines & Metals Co. was the State's leading zinc producer in 1949, followed by the Holden, Grandview, and Deep Creek mines, which together supplied 96 percent of the total zinc. Zinc-lead ore supplied over 59 percent of the zinc in 1949, zinc-copper ore 25, and zinc ore 15 percent.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Washington in 1949, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Benton		1	1	$35		
Chelan	3	1	48,183	1,686,405	135,662	$122,781
Ferry	3		23,751	831,285	153,429	138,861
Kittitas		1	2	70		
Okanogan	1				7,635	6,910
Pend Oreille	3				11,396	10,314
Snohomish	3		13	455	1,106	1,001
Stevens	15		21	735	48,604	43,989
Whatcom	1		23	805	21	19
Total: 1949	29	3	71,994	2,519,790	357,853	323,875
1948	30	1	70,075	2,452,625	375,831	340,146

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Benton							$35
Chelan	10,498,200	$2,068,145			5,447,000	$675,428	4,552,759
Ferry			400	$63	32,000	3,968	974,177
Kittitas							70
Okanogan	3,000	591	63,800	10,080	4,300	533	18,114
Pend Oreille	16,500	3,250	8,059,200	1,273,354	12,992,200	1,611,033	2,897,951
Snohomish	28,500	5,615	1,600	253			7,324
Stevens	3,800	749	4,709,000	744,022	3,004,500	372,558	1,162,053
Whatcom							824
Total: 1949	10,550,000	2,078,350	12,834,000	2,027,772	21,480,000	2,663,520	[illegible]
1948	11,330,000	2,458,610	14,294,000	2,558,626	25,276,000	3,361,708	11,171,715

MINING INDUSTRY

The number of producing lode mines in Washington declined from 30 in 1948 to 29 in 1949, but ore output rose almost 4 percent and was the greatest since 1944. Ore production increased at the Holden, Knob Hill, and Bonanza mines, and at the property of the Pend Oreille Mines & Metals Co.; declines were reported by the Aurum group and the Deep Creek and Grandview mines. The work stoppage at the Grandview mine, which began at midnight June 30, 1948, was settled on September 6, 1949.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Washington in 1949, with content in terms of recoverable metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold ore	5	69,836	28,989	158,242			
Dry silver ore	2	3,246		8,351	3,500	64,400	4,500
Copper ore	3	106	13	1,106	28,500	1,600	
Lead ore	6	14,422		36,027	3,300	4,005,060	3,255
Zinc ore	6	54,605	12	2,411		580,187	3,249,315
Zinc-copper ore	1	627,316	42,961	130,733	10,498,200		5,447,000
Zinc-lead ore	7	242,667	9	20,983	16,500	8,182,753	12,775,930
Total lode mines	[1] 29	1,012,198	71,984	357,853	10,550,000	12,834,000	21,480,000
Placers	3		10				
Total: 1949	[1] 32	1,012,198	71,994	357,853	10,550,000	12,834,000	21,480,000
1948	31	974,257	70,075	375,831	11,330,000	14,294,000	25,276,000

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

METALLURGIC INDUSTRY

Of the 1,012,198 tons of lode material sold or treated in Washington in 1949, 994,458 tons (98 percent) went to mills and 17,740 tons (2 percent) to smelters, compared with 98 and 2 percent, respectively, in 1948. The 994,458 tons treated at mills were distributed as follows: 1 plant, 627,316 tons of zinc-copper ore; 4 plants, 242,589 tons of zinc-lead ore; 3 plants, 52,547 tons of gold ore; 2 plants, 14,175 tons of lead ore; 3 plants, 54,586 tons of zinc ore; and 2 plants, 3,245 tons of silver ore.

Mine production of metals in Washington in 1949, by methods of recovery, in terms of recoverable metals

Method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Amalgamation	8				
Cyanidation	7,912	39,589			
Concentrates smelted	56,955	292,438	10,521,500	12,716,592	21,463,675
Ore smelted	7,109	25,826	28,500	117,408	16,325
Placer	10				
Total: 1949	71,994	357,853	10,550,000	12,834,000	21,480,000
1948	70,075	375,831	11,330,000	14,294,000	25,276,000

Gross metal content of Washington ore treated at mills in 1949, by classes of ore

Class of ore	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	52,547	24,793	150,042			
Dry silver	3,245		10,820	6,000	81,500	9,000
Lead	14,175		42,063	6,000	4,286,300	72,400
Zinc	54,586	24	3,073		671,788	3,930,420
Zinc-copper	627,316	49,197	197,083	11,434,952		8,091,517
Zinc-lead	242,589	12	33,050	30,000	8,516,178	14,624,818
Total: 1949	994,458	74,026	436,131	11,476,952	13,555,766	26,728,155
1948	954,502	73,977	447,625	12,001,224	15,873,303	31,024,899

Mine production of metals from mills in Washington in 1949, in terms of recoverable metals

	Material treated (short tons)	Recoverable in bullion		Concentrates smelted and recoverable metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds
BY COUNTIES									
Chelan	627, 336	3, 271	6, 644	28, 496	39, 705	124, 089	10, 498, 200		5, 447, 000
Ferry	52, 824	4, 649	32, 945	1, 304	17, 208	101, 137		400	32, 000
Okanogan	2, 405			60		7, 635	3, 000	63, 800	4, 300
Pend Oreille	243, 962			16, 775		11, 396	16, 500	8, 059, 200	12, 992, 200
Stevens	67, 788			6, 241	19	48, 160	3, 800	4, 593, 192	2, 988, 175
Whatcom	143			11	23	21			
Total: 1949	994, 458	7, 920	39, 589	52, 887	56, 955	292, 438	10, 521, 500	12, 716, 592	21, 463, 675
1948	954, 502	3, 889	25, 376	59, 480	60, 551	314, 327	11, 324, 900	14, 155, 787	25, 266, 194
BY CLASSES OF CONCENTRATES SMELTED									
Dry gold				1, 279	17, 238	101, 021			
Copper				22, 985	39, 292	119, 790	10, 408, 570	200	
Lead				9, 150	11	62, 297	8, 500	12, 317, 344	248, 910
Zinc				19, 385	414	9, 139	104, 300	369, 275	21, 195, 565
Zinc-lead				87		36		29, 373	19, 000
Zinc-lead-copper				1		155	130	400	200
Total 1949				52, 887	56, 955	292, 438	10, 521, 500	12, 716, 592	21, 463, 675

Gross metal content of concentrates produced from ores mined in Washington in 1949, by classes of concentrates smelted

Class of concentrate	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	1, 279	17, 238	101, 021			
Copper	22, 985	39, 292	119, 790	10, 730, 512	358	1, 365, 250
Lead	9, 150	11	62, 297	9, 916	12, 547, 376	359, 363
Zinc	19, 385	414	9, 139	154, 900	389, 685	21, 908, 800
Zinc-lead	87		36		29, 973	22, 958
Zinc-lead-copper	1		155	132	411	258
Total: 1949	52, 887	56, 955	292, 438	10, 895, 460	12, 967, 803	23, 656, 629
1948	59, 480	60, 551	314, 327	11, 686, 812	14, 471, 171	28, 275, 720

Gross metal content of Washington crude ore shipped to smelters in 1949, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	17,289	7,094	24,276			
Dry silver	1		60			
Copper	106	13	1,106	29,284	2,778	
Lead	247		104		106,120	4,412
Zinc	19		10		424	2,541
Zinc-lead	78	2	270		11,591	13,780
Total: 1949	17,740	7,109	25,826	29,284	120,913	20,733
1948	19,755	5,625	36,128	5,252	140,872	12,443

Mine production of metals from Washington crude ore shipped to smelters in 1949, in terms of recoverable metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Chelan	9,357	5,200	4,929			
Ferry	7,932	1,894	19,347			
Snohomish	106	13	1,106	28,500	1,600	
Stevens	345	2	444		115,808	16,325
Total: 1949	17,740	7,109	25,826	28,500	117,408	16,325
1948	19,755	5,625	36,128	5,100	138,213	9,806
BY CLASSES OF ORE						
Dry gold	17,289	7,094	24,276			
Dry silver	1		60			
Copper	106	13	1,106	28,500	1,600	
Lead	247		104		104,028	3,055
Zinc	19		10		400	2,000
Zinc-lead	78	2	270		11,380	11,270
Total 1949	17,740	7,109	25,826	28,500	117,408	16,325

REVIEW BY COUNTIES AND DISTRICTS

CHELAN COUNTY

Chelan Lake District.—The Howe Sound Co. operated its Holden mine and 2,000-ton concentration mill throughout 1949; 627,316 tons of zinc-copper ore were treated by selective flotation and 333,495 tons of current sands and slimes by cyanidation. Gross metal content of the ore treated was 49,197 ounces of gold, 197,083 ounces of silver, 11,434,952 pounds of copper, and 8,091,517 pounds of zinc.

Peshastin Creek (Blewett) District.—District output was principally 20 tons of gold ore from the Polepick claim.

Wenatchee District.—The E. H. Lovitt Syndicate opened the Gold King mine in July and during the remainder of the year shipped several thousand tons of highly siliceous gold ore to a smelter.

Mine production of gold, silver, copper, lead, and zinc in Washington in 1949, by counties and districts, in terms of recoverable metals

County and district	Mines producing: Lode	Mines producing: Placer	Ore sold or treated (short tons)	Gold (lode and placer, fine ounces)	Silver (lode,[1] fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
Benton County:									
Columbia River		1		1					$35
Chelan County:									
Chelan Lake, Peshastin Creek, Wenatchee [2]	3	1	636,693	48,183	135,662	10,498,200		5,447,000	4,552,759
Ferry County:									
Orient	1		440		137		400	32,000	4,155
Republic (Eureka)	2		60,316	23,751	153,292				970,022
Kittitas County:									
Swauk Creek		1		2					70
Okanogan County:									
Loomis-Oroville	1		2,405		7,635	3,000	63,800	4,300	18,114
Pend Oreille County:									
Metaline	3		243,962		11,396	16,500	8,059,200	12,992,200	2,897,951
Snohomish County:									
Everett	1		17	9	558	2,000	1,600		1,467
Index	2		89	4	548	26,500			5,857
Stevens County:									
Bossburg (Clugston Creek)	5		17,322	7	45,298	3,300	4,021,800	176,600	699,234
Chewelah	1		7	2	126		3,000	1,400	832
Colville-Middleport	1		19		10		400	2,000	320
Kettle Falls	1		841		716	500	600	200	867
Northport (Aladdin)	7		49,944	12	2,454		683,200	2,824,300	460,800
Whatcom County:									
Slate Creek	1		143	23	21				824
Total Washington	29	3	1,012,198	71,994	357,853	10,550,000	12,834,000	21,480,000	9,613,307

[1] No output of silver from placer operations in 1949.
[2] District production combined; Bureau of Mines not at liberty to publish individual production.

FERRY COUNTY

Orient District.—The Talisman Mining & Leasing Co. operated its mill during part of the year and shipped 37 tons of zinc concentrate from zinc ore produced.

Republic (Eureka) District.—Knob Hill Mines, Inc., operated its mine and 400-ton flotation-cyanidation mill on gold ore during all of 1949 and treated about 2 percent more ore than in 1948. The Aurum group of the Aurum Mining Co. was operated intermittently during the year by the company and by lessees; ore sold in 1949 was less than half of that sold in 1948.

OKANOGAN COUNTY

Loomis-Oroville District.—Kaaba Silver-Lead Mines, Inc., operated its Kaaba mine and mill from January to June 15, and shipped 60 tons of silver-lead concentrate from the treatment of 2,405 tons of silver ore in the company 300-ton sink-float-flotation mill.

PEND OREILLE COUNTY

Metaline District.—Following the settlement of its labor strike on September 6, the American Zinc, Lead & Smelting Co. resumed operations at its Grandview mine on September 20. During the remainder of the year the company treated 51,690 tons of zinc-lead ore in its 700-ton flotation mill.

The Pend Oreille Mines & Metals Co. operated its property and 700-ton flotation mill throughout 1949 and treated 186,955 tons of zinc-lead ore, compared with 133,755 tons in 1948. Gross metal content of the ore in 1949 was 18,000 ounces of silver, 30,000 pounds of copper, 6,655,598 pounds of lead, and 9,646,878 pounds of zinc. The mill produced 4,365 tons of lead concentrate and 7,313 tons of zinc concentrate.

The Metaline Mining & Leasing Co. resumed operations in September when ore-treatment facilities became available at the Grandview mill of the American Zinc, Lead & Smelting Co. During the remainder of the year 5,317 tons of zinc-lead ore were milled.

SNOHOMISH COUNTY

Index District.—District production was all copper smelting ore—84 tons from the Sunset mine, which contained 4 ounces of gold, 519 ounces of silver, and 25,680 pounds of copper; and 5 tons from the Wilbur-Index group.

STEVENS COUNTY

Bossburg (Clugston Creek) District.—Bonanza Lead operated its Bonanza mine throughout the year and treated, in the company 100-ton flotation mill, 14,163 tons (12,386 tons in 1948) of lead ore containing 42,000 ounces of silver, 6,000 pounds of copper, 4,285,000 pounds of lead, and 72,000 pounds of zinc; the mill produced 3,108 tons of lead concentrate. Zinc-lead milling ore was produced from the Young America mine; shipments comprised 60 tons of lead concentrate and 161 tons of zinc concentrate. Remaining district production was mainly 27 tons of zinc-lead ore and 12 tons of lead ore from the High Cliff mine and 21 tons of lead ore from the Colville Queen claim.

Kettle Falls District.—The Warfield-Munsell Mining Co. did prospecting and developing at the Silver Queen (Ark) mine during the first 6 months of the year; about 1 ton of high-grade silver ore was shipped to a smelter, and 840 tons of low-grade silver ore were treated in the 40-ton flotation mill on the property.

Northport (Aladdin) District.—The Deep Creek mine and 260-ton flotation mill of the Goldfield Consolidated Mines Co. operated on zinc ore in 1949; the mill treated 45,439 tons of ore containing 24 ounces of gold, 2,700 ounces of silver, 635,000 pounds of lead, and 3,230,000 pounds of zinc. The Admiral mine of the Admiral Consolidated Mining Co. was operated until September 1. About 390 tons of zinc ore were treated in the company 75-ton flotation mill; gross metal content was 20 ounces of silver, 1,500 pounds of lead, and 42,000 pounds of zinc. The mill produced 25 tons of zinc concentrate and about 1 ton of lead concentrate. Leadpoint Electric Mining Co. operated the Electric Point mine and shipped 106 tons of lead ore to a

smelter, and 115 tons of similar ore were shipped from the Gladstone Mountain mine by the Gladstone Mountain Mining Co. About 3,000 tons of zinc ore from the Iroquois dump were hauled to a custom mill for treatment by the Mines Management, Inc. Last Chance Consolidated Mines, Inc., operated the Last Chance group and treated about 850 tons of zinc-lead ore in the company 100-ton gravity-flotation mill. Consolidated Speculator Corp. operated the Lucille group until October and shipped 44 tons of zinc-lead ore to a smelter.

WHATCOM COUNTY

Slate Creek District.—The Slate Creek Mining Co. operated the Bonita-New Light-Eureka Gold group for 2½ months in 1949 and treated 143 tons of gold ore in the company flotation mill.

Wyoming
Gold, Silver, Copper, and Lead

(MINE REPORT)

By A. J. Martin

GENERAL SUMMARY

MINES in Wyoming produced 389 fine ounces of gold and 21 fine ounces of silver in 1949 compared with 115 ounces of gold and 11 ounces of silver in 1948. Nearly all the output in both years came from the Carissa mine in the South Pass district, Fremont County. This mine had a substantial output in 1947 and was under development, with intermittent production in 1948 and 1949. No output of copper, lead, or zinc was reported in the State in 1948 or 1949.

Records of past production credit Wyoming with an output of gold, silver, copper, and lead valued altogether at $7,647,183 from 1867 through 1949. Copper represented about three-fourths of the total value and was mined in the Copper Mountain district, Fremont County; Encampment district, Carbon County; Hartville district, originally in Laramie County, now in Platte County; and Laramie (Douglas Creek) district, Albany County. The lead came from the Spring Creek district in Carbon County, the Hurricane district in Crook County, and the Douglas Creek district in Albany County. Gold and silver were produced from many localities throughout the State.

All tonnage figures are short tons and "dry weight," that is, they do not include moisture.

The value of the metal production reported herein has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1945–49

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1945	$35.00	$0.711+	$0.135	$0.086	$0.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121
1948	35.00	.905+	.217	.179	.133
1949	35.00	.905+	.197	.158	.124

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver. 1945 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905; 1948–49: $0.9050505.
[3] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1945–47 includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, and lead in Wyoming, 1945–49, and total, 1867–1949, in terms of recoverable metals

Year	Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Total value
		Fine ounces	Value	Fine ounces	Value	Short tons	Value	Short tons	Value	
1945	52	2	$70	31	$22			3	$516	$608
1946	61	105	3,675	26	21	[1] 1	$324			4,020
1947	6,059	1,486	52,010	95	86					52,096
1948	867	115	4,025	11	10					4,035
1949	[2] 1,800	389	13,615	21	19					13,634
1867–1949	(3)	80,031	1,909,413	74,819	51,912	16,326	5,684,372	14	1,486	7,647,183

[1] Includes less than ½ ton of recoverable copper produced in 1945 from the Bartlett (Copper King) mine in Laramie County.
[2] Ore milled; recovery was 86 ounces of gold and 3 ounces of silver in amalgamation and cyanidation bullion and 300 ounces of gold and 18 ounces of silver in 35 tons of concentrates smelted.
[3] Figure not available.

Mine production of gold and silver in Wyoming, 1949, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)
January–February		
March	2	
April	98	5
May	56	3
June		
July	59	3
August	121	7
September	10	1
October	35	2
November	8	
December		
Total: 1949	389	21
1948	115	11

REVIEW BY COUNTIES

FREMONT COUNTY

Development work was continued at the Carissa mine in the South Pass district, and ore was mined intermittently during 1949. The ore was treated in a mill at the mine. The mill equipment includes crushers, a ball mill, two-cell mineral jig, amalgamation barrel, classifier, thickening tanks, cyanide-leaching tanks, precipitators, and a melting furnace. David F. Haddenham drove 82 feet of tunnel on his St. Louis property south of Atlantic City and shipped a little gold recovered from pannings obtained in sampling. Previous development on the property included a 110-foot shaft and a 285-foot tunnel. A placer miner shipped 1.5 ounces of crude placer gold.

TETON COUNTY

One ounce of gold was recovered while assessment work was being done on the Sterling placer on Pacific Creek, 15 miles northeast of Moran. A small placer machine used on the Mercury claim 10 miles below the Moran Dam recovered 2 ounces of material containing 1 fine ounce of gold.

PART IV. FOREIGN REVIEW

Mineral Production of the World, 1948–49

❖

By Berenice B. Mitchell, Pauline Roberts, and Helen L. Hunt[1]

THE statistical tables in this chapter present, for every country, the quantities of each major mineral produced in 1948–49. The figures are on a mine basis, unless otherwise indicated, except for cement, coke, nitrogen, and steel, which are measured at the processing plant. The tables are essentially a retabulation, by countries, of the 54 commodity world tables appearing in the various chapters of this volume. For lack of comprehensive information, data for the following minerals are excluded: Andalusite, aplite, asphalt, boron, bromine, calcite (optical), calcium chloride (natural), carbon dioxide, clay, columbium (niobium), diatomite (kieselguhr), dumortierite, emery, garnet (abrasive), gem stones (other than diamonds), germanium, greensand, grindstones, helium, indium, iodine, kyanite, lithium, magnesium compounds (other than magnesite), meerschaum, mineral pigments, monazite, natural gas, natural gasoline, oil shale, olivine, perlite, pumice, quartz crystal, radium, sand and gravel, selenium, sillimanite, sodium salts (other than common salt), stone, strontium, sulfur (byproduct), tantalum, tellurium, thallium, topaz (industrial), tripoli, uranium, vermiculite, wollastonite, and zirconium.

The statistics in these tables were derived principally from questionnaires sent, in cooperation with the United States Department of State, to the governments of each country. Supplementary sources were United States consular reports, the Imperial Institute's Mineral Industry of the British Commonwealth and Foreign Countries—Statistical Summary, other official publications of various countries, the United Nations Statistical Yearbook, the Year Book of the American Bureau of Metal Statistics, Minerais et Metaux, business magazines, and company reports. Where official data were not available, estimates were often supplied by Bureau of Mines commodity specialists.

Tables similar to those in this chapter and covering 1924–29 were published by the Bureau of Mines in Mineral Resources of the United States, 1930, part I, pages 859–962.

In the following tables, figures marked with an asterisk (*) are preliminary. Coke entries are for coke made at high temperatures (over 1,000° C.) in slot-type or beehive ovens and exclude gas house or retort coke.

[1] Assisted by Viola M. Haslacker and Anna P. Lake.

NORTH AMERICA

BRITISH WEST INDIES

TABLE 1.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Salt:			Petroleum, crude: Barbados	(3)	(3)
Bahamas	63,000	60,960			
Turks and Caicos Islands	38,610	(2)			

[1] The following minerals are produced, but data are not available: Cayman Islands, phosphate rock; Jamaica, bauxite, and gypsum; Leeward Islands, salt. See also p. 1603.
[2] Data not available.
[3] Less than 500 barrels.

CANADA (INCLUDING NEWFOUNDLAND)

TABLE 2.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949
Aluminum, smelter	333,007	332,799
Antimony [1]	129	64
Arsenic, white, smelter	527	272
Asbestos (sales)[2]	650,239	521,543
Barite	86,860	36,029
Bismuth (kilograms)[3]	108,971	93,893
Cadmium, smelter (kilograms)	347,491	383,185
Cement, hydraulic	2,242,773	2,541,536
Chromite	1,556	242
Coal:		
Coal (thousand tons)	15,296	15,640
Lignite (thousand tons)	1,442	1,696
Cobalt [4]	701	278
Coke	3,116,221	3,041,315
Copper:		
Mine	222,513	239,149
Smelter	200,736	206,394
Feldspar (shipments)	49,760	30,475
Fluorspar	58,120	56,212
Fuel briquets	323,133	459,908
Gold (troy ounces)	3,529,608	4,103,856
Graphite	2,303	1,905
Gypsum	3,164,211	2,716,820
Iron ore	2,704,739	3,424,174
Iron and steel:		
Pig iron and ferro-alloys	2,151,439	2,146,347
Steel ingots and castings	2,903,411	2,891,119
Lead:		
Mine	171,800	165,419
Smelter	145,246	132,582
Magnesite	(5)	(5)

Mineral	1948	1949
Manganese ore (shipments)	3	----------
Mica (sales)	3,584	821
Molybdenum	83	----------
Nickel	119,512	116,417
Nitrogen, fertilizer [6]	160,570	175,420
Peat:		
Fuel	77	51
Peat moss	81,465	56,074
Petroleum, crude (thousand barrels)	12,287	22,220
Phosphate rock	----------	11
Platinum-group metals:		
Platinum (troy ounces)	121,404	151,317
Other platinum-group metals (troy ounces)	148,343	192,106
Pyrites (including cupreous pyrites)	166,985	226,958
Salt	672,457	680,137
Silver (troy ounces)	16,109,982	16,937,641
Talc, pyrophyllite, and soapstone	26,109	25,198
Tin:		
Mine (long tons)	309	276
Smelter (long tons)	309	276
Titanium concentrates: Ilmenite	4,029	----------
Tungsten concentrates, 60% WO_3 basis	791	191
Zinc:		
Mine	247,780	263,710
Smelter	178,329	187,588

[1] Includes antimony content of antimonial lead.
[2] Exclusive of sand, gravel, and stone.
[3] Refined metal, plus bismuth content of bullion exported.
[4] Figures comprise Canadian ore processed in Canada and exported (irrespective of year when mined), plus cobalt content of oxide made from Sudbury ore at Port Colborne.
[5] Actually magnesitic dolomite and brucite valued at C$1,587,709 in 1948 and C$1,536,200 in 1949. Tonnage data not available.
[6] Fiscal year ended June 30 of year stated.

COSTA RICA

TABLE 3.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Gold (troy ounces) [2]	1,096	284	Silver (troy ounces) [2] [4]	3,029	720
Salt	6,500	(3)			

[1] Manganese ore is produced, but data are not available. See also p. 1603.
[2] Imports into United States.
[3] Data not available.
[4] Including scrap.

CUBA

TABLE 4.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Barite (exports)		(2)	Iron ore	36,595	11,961
Cement, hydraulic	284,954	313,300	Manganese ore	29,073	62,503
Chromite	116,624	97,368	Petroleum, crude (thousand barrels) [4]	*159	*206
Copper	16,300	17,400	Salt	*56,000	(2)
Gold (troy ounces)	334	[3] 5,692	Silver (troy ounces) [3] [5]	185,216	157,411
Gypsum	*16,500	*13,880			

[1] Magnesite and sulfur are produced but data are not available. See also p. 1603.
[2] Data not available.
[3] Imports into United States.
[4] Natural naphtha and gas oil.
[5] Including scrap.

DOMINICAN REPUBLIC

TABLE 5.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Cement, hydraulic	43,452	53,561	Gypsum	7,304	(2)
Gold (troy ounces) [1]	29	993	Salt	16,946	(2)

[1] Imports into United States.
[2] Data not available.

EL SALVADOR

TABLE 6.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Gold (exports) (troy ounces)	20,778	*25,000	Silver (troy ounces)	[3] 216,342	[3] 275,605
Salt	21,213	(1)			

[1] Data not available.
[2] Exports.
[3] Imports into United States.

GREENLAND

TABLE 7.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Coal (thousand tons)	8	(2)
Cryolite (exports)	24,380	40,990

[1] Graphite is produced, but data are not available. See also p. 1603.
[2] Data not available.

GUATEMALA

TABLE 8.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Cement, hydraulic	31,573	35,852	Lead, smelter	(3)	68
Chromite	474	300	Salt	*10,614	11,962
Gold (troy ounces) [2]	16	5			

[1] Sulfur and mica are produced, but data are not available. See also p. 1603.
[2] Imports into United States.
[3] Data not available.

HAITI

Production of salt in Haiti in 1948 totaled 8,000 metric tons (preliminary figure). Data for 1949 are not available.

HONDURAS

TABLE 9.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Antimony	5	8	Salt	1,089	(1)
Gold (troy ounces)	13,633	25,832	Silver (troy ounces)	3,170,871	3,431,614

[1] Data not available.

MEXICO

TABLE 10.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony [2]	6,790	5,293	Lead:		
Arsenic, white, smelter	7,571	3,576	Mine	193,300	220,763
Bismuth, in impure bars (kilograms)	154,000	249,000	Smelter	187,067	212,044
Cadmium (kilograms) [3]	905,000	819,000	Manganese ore	53,800	[5] 54,671
Cement, hydraulic	833,444	1,227,600	Mercury (flasks)	4,786	5,250
Chromite	----------	(4)	Petroleum, crude (thousand barrels)	58,508	60,910
Coal (thousand tons)	1,057	*1,028	Salt	*156,685	(4)
Coke	408,000	374,827	Silver (troy ounces)	57,519,703	49,447,842
Copper:			Sulfur, native (long tons)	2,100	(4)
Mine	59,076	57,246	Tin:		
Smelter	48,761	49,359	Mine (long tons)	182	358
Fluorspar (exports)	75,381	*56,000	Smelter (long tons)	181	358
Gold (troy ounces)	367,612	405,550	Tungsten concentrates, 60 percent WO_3 basis	168	82
Graphite	35,261	23,812	Zinc:		
Iron ore	333,100	362,600	Mine	154,340	172,320
Iron and steel:			Smelter	48,323	53,496
Pig iron	270,391	355,760			
Steel ingots and castings	268,800	*358,300			

[1] Barite, fuel briquets, gypsum, magnesite, and mica are produced but data are not available. See also p. 1603.
[2] Includes antimonial content of antimonial lead.
[3] Cadmium content of flue dust exported for treatment elsewhere; represents in part shipments from stocks on hand.
[4] Data not available.
[5] United States imports from Mexico.

PANAMA

TABLE 11.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949
Cement	41, 300	53, 600
Gold (troy ounces)	1, 000	[1] 9, 657
Salt	3, 374	* 3, 300

[1] Exports.

TRINIDAD

Production of crude petroleum in Trinidad totaled 20,111,000 barrels in 1948 and 20,617,000 barrels in 1949.

UNITED STATES (INCLUDING TERRITORIES)

TABLE 12.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Aluminum, smelter	565, 587	547, 449
Antimony	5, 416	1, 365
Arsenic, white, smelter	16, 909	11, 607
Asbestos (sold or used by producers)	33, 649	39, 360
Barite	705, 642	663, 428
Bauxite (dried equivalent)	1, 480, 535	1, 167, 230
Beryllium concentrates (mine shipments)	90	314
Cadmium, smelter:		
Metallic cadmium (kilograms)	3, 439, 555	3, 639, 432
Cadmium compounds (Cd content, kilograms)	87, 405	159, 185
Cement, hydraulic	35, 626, 454	36, 312, 780
Chromite	3, 283	393
Coal:		
Anthracite, Pennsylvania (thousand tons)	51, 836	38, 738
Bituminous (thousand tons)	541, 072	391, 898
Lignite (thousand tons)	2, 799	2, 725
Cobalt (shipments)	263	306
Coke, metallurgical	67, 913, 244	57, 730, 603
Copper:		
Mine	757, 326	682, 880
Smelter [2]	839, 550	779, 842
Feldspar (sold or used by producers)	468, 107	375, 307
Fluorspar (shipments)	300, 956	214, 733
Fuel briquets:		
Briquets	2, 838, 092	2, 180, 834
Packaged fuel	142, 439	114, 258
Gold (fine ounces) [3]	2, 025, 480	1, 921, 949
Graphite	9, 026	5, 536
Gypsum	6, 581, 169	5, 994, 752
Iron ore	102, 624, 598	86, 300, 694
Iron and steel:		
Pig iron and ferro-alloys	56, 214, 008	49, 774, 775
Steel ingots and castings [4]	80, 412, 862	70, 740, 242
Lead:		
Mine	354, 232	371, 860
Refinery [5]	363, 092	431, 695
Magnesite	(6)	260, 646
Magnesium metal	9, 075	10, 521
Manganese ore (shipments)	118, 931	114, 427
Mercury (flasks)	14, 388	9, 930
Mica (sold or used by producers):		
Block	122	233
Scrap	47, 316	29, 806
Molybdenum	12, 114	10, 219
Nickel, refinery	801	717
Nitrogen, fertilizer [7]	905, 260	975, 000
Peat	117, 553	117, 509
Petroleum, crude (thousand barrels)	2, 020, 185	1, 840, 307
Phosphate rock (sold or used by producers)	8, 807, 903	9, 131, 173
Platinum-group metals (troy ounces):		
Platinum	14, 992	19, 013
Other platinum-group metals	4, 261	5, 794
Potassium salts (equivalent K_2O)	1, 034, 077	1, 014, 586
Pyrites, including cupreous pyrites	943, 434	905, 746
Salt:		
Rock salt	3, 489, 782	3, 146, 105
Other salt	11, 390, 957	10, 997, 464
Silver (troy ounces)	39, 228, 468	34, 944, 554
Sulfur, native (long tons)	4, 869, 210	4, 745, 014
Talc, pyrophyllite, and soapstone (sold by producers)	470, 596	412, 023
Tin:		
Mine (long tons)	5	68
Smelter (long tons) [8]	36, 703	35, 834
Titanium concentrates:		
Ilmenite	348, 126	364, 989
Rutile	6, 695	10, 875
Tungsten concentrates, 60% WO_3 basis (shipments)	3, 659	2, 568
Zinc:		
Mine	571, 506	538, 145
Smelter	714, 644	739, 154

[1] Excludes bismuth and vanadium, data for which Bureau of Mines is not at liberty to publish. See also p. 1603.
[2] Smelter output from domestic and foreign ores, exclusive of scrap. Production from domestic ores only was as follows: 1948, 764,278 tons; 1949, 687,580 tons.
[3] Refinery production.
[4] Data from American Iron and Steel Institute. Includes only that portion of steel for castings, produced in foundries operated by companies manufacturing steel ingots.
[5] Figures cover lead refined from domestic and foreign ores but not from foreign base bullion.
[6] Bureau of Mines not at liberty to publish figures.
[7] Fiscal year ended June 30 of year stated.
[8] Including tin content of ores used direct to make alloys.

SOUTH AMERICA

ARGENTINA

TABLE 13.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Beryllium concentrates	[2] 50	(3)
Cement, hydraulic	1,251,770	1,445,862
Chromite	-------	(3)
Gold (troy ounces)	*8,000	*8,000
Lead:		
Mine	21,800	16,000
Smelter	17,830	15,000
Petroleum, crude (thousand barrels)	23,734	22,961
Silver (troy ounces)	*1,201,900	*1,249,421
Sulfur, native (long tons)	(3)	9,842
Tin:		
Mine (long tons)	273	*300
Smelter (long tons)	254	*300
Tungsten concentrates, 60% WO_3 basis	33	(3)
Zinc:		
Mine	10,970	9,830
Smelter	1,602	2,648

[1] Antimony, arsenic, asbestos, barite, bismuth, coal, corundum, feldspar, fluorspar, graphite, gypsum, iron ore, magnesite, manganese ore, mica, peat, salt, talc, and vanadium are produced, but data are not available. See also p. 1603.
[2] Estimate based on United States imports.
[3] Data not available.

BOLIVIA

TABLE 14.—Mineral production,[1] 1948–49, in metric tons

Mineral [2]	1948	1949
Antimony	11,280	9,453
Asbestos	147	(3)
Bismuth in ore and bullion [4]	35,142	8,222
Cement, hydraulic	39,130	41,546
Cobalt	-------	(3)
Copper, mine	6,616	5,074
Fluorspar	227	264
Gold (fine ounces)	4,063	32,415
Lead	25,600	26,352
Petroleum, crude (thousand barrels)	464	678
Silver (fine ounces)	7,562,208	6,634,627
Sulfur, native (long tons)	2,707	4,398
Tin:		
Mine (long tons)	37,336	34,115
Smelter (long tons)	81	402
Tungsten concentrates, 60 percent WO_3 basis	2,485	2,543
Zinc	21,124	14,197

[1] All data are exports, except that those for cement, lead, petroleum, and zinc are actual production.
[2] Mica and salt are produced, but data are not available. See also p. 1603.
[3] Data not available.
[4] Excludes bismuth content of tin concentrates exported.

BRAZIL

TABLE 15.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Arsenic, white, smelter	984	(2)
Barite	*10,000	(2)
Bauxite	*17,000	20,246
Beryllium concentrates (exports)	1,783	3,078
Cement, hydraulic	1,111,503	1,281,047
Chromite (exports)	1,626	(2)
Coal (thousand tons)	*2,013	*2,140
Coke	265,753	(2)
Diamonds (metric carats)	*250,000	*250,000
Feldspar	189	(2)
Fluorspar	751	537
Gold (troy ounces)	*156,900	*183,500
Graphite (exports)	83	(2)
Gypsum	(2)	50,857
Iron ore	1,441,119	(2)
Iron and steel:		
Pig iron and ferro-alloys	551,813	508,219
Steel ingots and castings	483,085	605,451
Magnesite	850	43,110
Manganese ore (exports)	141,253	(2)
Mica	[3] 987	7,260
Nickel	-------	(2)
Petroleum, crude (thousand barrels)	144	109
Phosphate rock	(2)	4,553
Pyrites, including cupreous pyrites	3,600	(2)
Salt	781,378	(2)
Silver (troy ounces)	23,095	21,041
Tin:		
Mine (long tons)	570	325
Smelter (long tons)	*240	325
Titanium concentrates:		
Ilmenite (exports)	7,900	(2)
Rutile (exports)	-------	(2)
Tungsten concentrates, 60% WO_3 basis (exports)	1,144	575

[1] Asbestos, bismuth, cobalt, corundum, and talc are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Exports.

BRITISH GUIANA

TABLE 16.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949
Bauxite	1,903,230	1,785,860
Diamonds (metric carats)	36,562	34,790
Gold (troy ounces)	16,518	19,368

CHILE

TABLE 17.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Asbestos	150	(2)	Iron and steel—Continued		
Barite	2,141	(2)	Steel ingots and castings	13,000	31,560
Cement, hydraulic	539,789	495,208	Lead		730
Coal (thousand tons)	2,109	*1,800	Manganese ore	20,498	(2)
Cobalt		(2)	Mercury (flasks)	467	(2)
Copper:			Molybdenum	532	558
Mine	448,289	367,036	Nitrogen, fertilizer [3]	274,080	275,270
Smelter	424,881	351,314	Phosphate rock	59,529	(2)
Feldspar	885	(2)	Salt:		
Gold (troy ounces)	164,258	179,144	Rock salt	47,164	(2)
Gypsum	35,056	(2)	Other salt	*30,804	(2)
Iron ore	2,545,401	2,597,330	Silver (troy ounces)	861,961	799,685
Iron and steel:			Sulfur, native (long tons)	13,258	(2)
Pig iron and ferro-alloys	14,000	(2)	Talc and soapstone	270	(2)

[1] Potassium salts are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Fiscal year June 30 of year stated.

COLOMBIA

TABLE 18.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Barite	120	(2)	Petroleum, crude (thousand barrels)	23,792	29,722
Cement, hydraulic	363,749	475,777	Platinum (troy ounces)	40,047	(2)
Coal (thousand tons)	*900	(2)	Salt	124,081	[3] 52,573
Gold (troy ounces)	335,260	359,474	Silver (troy ounces)	109,188	106,590
Gypsum	4,200	(2)			

[1] Mica is produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] January to June, inclusive.

CURAÇAO

TABLE 19.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Phosphate rock	58,827	92,784
Salt	482	(2)

[1] Fuel briquets are produced but data are not available. See also p. 1603.
[2] Data not available.

ECUADOR

TABLE 20.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Cement, hydraulic	40,369	52,250	Salt	*23,000	(2)
Copper [1]	482	676	Silver (troy ounces)	226,664	279,247
Gold (troy ounces)	79,207	99,241	Sulfur, native (long tons)	43	16
Gypsum	410	486			
Petroleum, crude (thousand barrels)	2,563	2,617			

[1] United States imports.
[2] Data not available.

FRENCH GUIANA

Production of gold in French Guiana totaled 13,625 troy ounces in 1948 and 15,000 ounces (preliminary figure) in 1949.

NICARAGUA

TABLE 21.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Cement, hydraulic	16,220	16,462	Salt	*9,475	*10,230
Gold (exports) (troy ounces)	222,627	219,139	Silver (exports) (troy ounces)	212,463	206,507

PERU

TABLE 22.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	1,470	750	Molybdenum	3	2
Arsenic, white, smelter	1,011	500	Petroleum, crude (thousand barrels)	14,069	14,790
Bismuth:			Salt	60,002	60,000
Metal (kilograms)	205,861	213,137	Silver (troy ounces)	9,288,777	10,627,717
In lead-bismuth alloy (kilograms)	47,225	2,398	Sulfur, native (long tons)	971	271
Cadmium (kilograms)	1,592	800	Tin (long tons)	64	44
Cement, hydraulic	282,373	280,500	Tungsten concentrates, 60 percent WO_3 basis	353	250
Coke	1,763	(2)	Vanadium	511	456
Copper:			Zinc:		
Mine	18,068	28,373	Mine	52,927	64,283
Smelter	11,824	21,138	Smelter	1,464	1,261
Coal (thousand tons)	189	200			
Gold (troy ounces)	111,162	137,963			
Gypsum	46,716	(2)			
Lead:					
Mine	48,500	49,302			
Smelter	34,297	36,027			

[1] Barite and feldspar are produced, but data are not available. See also p. 1603.
[2] Data not available.

SURINAM

TABLE 23.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949
Bauxite	2,149,906	2,126,654
Gold (troy ounces)	4,177	3,794

URUGUAY

TABLE 24.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Cement, hydraulic	278,203	(2)	Mica	2	2
Feldspar	4,877	811	Talc and soapstone	2,984	660
Gold (troy ounces)	--------	(2)			

[1] Pyrites are produced, but data are not available. See also p. 1603.
[2] Data not available.

VENEZUELA

TABLE 25.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Asbestos	192	*200	Gypsum	(1)	3,042
Cement, hydraulic	214,513	285,000	Magnesite	1,900	--------
Coal (thousand tons)	21	(1)	Petroleum, crude (thousand barrels)	490,015	482,316
Diamonds (metric carats)	75,513	56,362	Salt	35,533	71,000
Gold (troy ounces)	49,730	61,378			

[1] Data not available.

EUROPE

ALBANIA

TABLE 26.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Chromite	[2] 16,500	(3)
Petroleum, crude (thousand barrels)	*1,500	*2,188

[1] Cement, coal, and salt are produced, but data are not available. See also p. 1603.
[2] Planned production.
[3] Data not available.

AUSTRIA

TABLE 27.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminium, smelter	13,319	*17,000	Lead:		
Antimony [2]	247	349	Mine	3,007	4,297
Barite	3,842	3,135	Smelter	9,350	9,841
Bauxite	5,324	6,526	Magnesite	405,600	520,500
Cement, hydraulic	721,379	1,091,012	Mica	95	253
Coal:			Nitrogen, fertilizer [3]	43,500	58,000
Bituminous (thousand tons)	181	183	Petroleum, crude (thousand barrels)	6,149	6,100
Lignite (thousand tons)	3,338	3,816	Pyrites (including cupreous pyrites)	7,871	11,672
Coke	591,100	775,900	Salt:		
Copper:			Rock salt	1,752	(4)
Mine	982	1,296	Other salt	197,615	(4)
Smelter	2,143	3,761	Talc and soapstone	47,300	52,144
Feldspar	1,144	1,912	Tungsten concentrates, 60% WO_3 basis	--------	(4)
Graphite	11,300	14,093	Zinc	1,920	2,420
Iron ore	1,269,100	1,487,616			
Iron and steel:					
Pig iron and ferro-alloys	613,209	837,748			
Steel ingots and castings	648,181	834,574			

[1] Arsenic, gold, mercury, phosphate rock, and silver are produced but data are not available. See also p. 1603.
[2] Excludes Soviet Zone, production data for which are not available.
[3] Fiscal year ended June 30 of year stated.
[4] Data not available.

BELGIUM

TABLE 28.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Arsenic, white, smelter (exports)	151	527	Iron ore	96,720	41,760
Cadmium, smelter (kilograms)	[2] 157,900	(3)	Iron and steel:		
Cement, hydraulic	3,330,948	2,924,998	Pig iron and ferro-alloys	3,936,909	3,742,761
Coal (thousand tons)	26,679	27,850	Steel ingots and castings	3,893,820	3,818,323
Coke	3,733,858	3,472,284	Lead, smelter [5]	66,035	79,303
Copper, smelter [4]	----------	(3)	Nitrogen, fertilizer [6]	146,520	152,130
Fuel briquets	988,790	780,860	Phosphate rock	68,938	44,643
			Tin, smelter (long tons)	10,469	8,996
			Zinc, smelter	153,928	176,565

[1] Barite, manganese ore, and pyrites are produced, but data are not available. See also p. 1603.
[2] Incomplete data.
[3] Data not available.
[4] Figures represent blister copper only. Belgium reports a large output of refined copper which is not included above, as it is believed produced principally from crude copper from Belgian Congo and would therefore duplicate output reported under the latter country.
[5] Includes scrap.
[6] Fiscal year ended June 30 of year stated.

BULGARIA

TABLE 29.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Cement, hydraulic	*325,000	(2)	Coke, metallurgical	*8,600	(2)
Coal: Lignite (thousand tons)	*4,250	(2)	Salt	*120,000	(2)

[1] Asbestos, bituminous coal and anthracite, chromite, fuel briquets, gold, graphite, iron ore, manganese ore, silver, and talc are produced, but data are not available. See also p. 1603.
[2] Data not available.

CZECHOSLOVAKIA

TABLE 30.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	1,600	(2)	Lead, smelter	5,770	(2)
Cement, hydraulic	1,650,000	1,738,000	Mercury (flasks)	800	(2)
Coal:			Petroleum, crude (thousand barrels)	204	292
Bituminous (thousand tons)	17,746	17,003	Pyrites, including cupreous pyrites	3,195	(2)
Lignite (thousand tons)	23,589	26,526	Silver (troy ounces)	*1,600,000	(2)
Coke	5,224,000	6,589,000	Tungsten concentrates, 60 percent WO_3 basis	----------	(2)
Fuel briquets, lignite	291,326	(2)			
Graphite	15,000	(2)			
Iron ore	1,428,000	*1,400,000			
Iron and steel:					
Pig iron and ferro-alloys	1,660,000	1,875,000			
Steel ingots and castings	2,650,000	*2,903,000			

[1] Arsenic, asbestos, barite, feldspar, fuel briquets (bituminous), gold, lead, magnesite, manganese ore, salt, and zinc (smelter) are produced, but data are not available. See also p. 1603.
[2] Data not available.

DENMARK

TABLE 31.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Cement, hydraulic	809,923	834,000	Peat	3,616,860	1,416,000
Coal: Lignite (thousand tons)	2,347	1,426	Steel ingots and castings	----------	*81,000

FAROE ISLANDS

Coal is produced in Faroe Islands but data are not available.

FINLAND

TABLE 32.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Asbestos, including flour	10,818	(2)	Lead	72	130
Cement, hydraulic	555,800	655,984	Peat	8,277	(2)
Copper:			Pyrites, including cupreous pyrites	177,512	(2)
Mine	18,384	18,741	Silver (troy ounces)	167,615	171,150
Smelter	20,672	18,224	Talc and soapstone	237	(2)
Feldspar	6,064	10,074			
Gold (troy ounces)	11,317	14,050			
Gypsum	1,711	(2)			
Iron and steel:					
Pig iron and ferro-alloys	90,049	101,211			
Steel ingots and castings	108,715	113,632			

[1] Beryl, cobalt, and zinc are produced, but data are not available. See also p. 1603.
[2] Data not available.

FRANCE

TABLE 33.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	64,785	59,000	Lead:		
Arsenic, white, smelter	3,000	(2)	Mine	7,413	10,009
Bauxite	788,400	757,560	Smelter	34,702	54,450
Bismuth (kilograms)	*30,000	*30,000	Magnesium metal	1,507	*700
Cadmium, smelter (kilograms)	50,067	(2)	Nitrogen, fertilizer [3]	169,700	187,500
Cement, hydraulic	5,379,000	6,443,352	Petroleum, crude (thousand barrels)	370	411
Coal:			Potassium salts (equivalent K_2O)	769,900	[3] *900,000
Bituminous and anthracite (thousand tons)	43,291	51,199	Pyrites, including cupreous pyrites	179,000	(2)
Saar production (thousand tons)	12,567	14,262	Silver (troy ounces)	494,403	395,445
Lignite (thousand tons)	1,838	1,845	Sulfur, native (content of ore, long tons)	13,779	(2)
Coke	6,099,000	6,769,000	Talc, and soapstone	98,248	(2)
Saar production	2,740,000	3,327,000	Tin (long tons)	84	73
Fluorspar	32,000	(2)	Tungsten concentrates, 60% WO_3 basis	563	*500
Fuel briquets	5,948,000	(2)	Zinc:		
Gold (troy ounces)	34,498	47,294	Mine	4,633	9,870
Iron ore	23,031,000	31,424,000	Smelter	55,514	[illegible]
Iron and steel:					
Pig iron and ferro-alloys	6,559,000	8,355,000			
Saar production	1,134,000	1,581,000			
Steel ingots and castings	7,242,925	9,108,000			
Saar production	1,228,000	1,757,000			

[1] Antimony, asbestos, barite, beryl, copper, feldspar, gypsum, molybdenum, peat, phosphate rock, and salt are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Fiscal year ended June 30 of year stated.

GERMANY

TABLE 34.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter [2]	7,306	23,975	Magnesite [4]	(7)	11,264
Barite	[3] 41,000	183,457	Magnesium, metal [2]	17	----------
Cadmium, smelter (kilograms)[2]	3,500	5,000	Manganese ore	[2] 33,600	(7)
Cement, hydraulic [4]	5,581,200	8,460,000	Nitrogen, fertilizer: [8]		
Coal:			Federal Republic	230,000	327,600
Bituminous and anthracite (thousand tons)	91,246	*108,000	Soviet zone	120,000	110,000
Lignite (thousand tons)	175,736	*190,000	Peat	[2] 2,038,000	[3] 1,155,000
Coke [2]	18,979,000	23,543,000	Petroleum, crude (thousand barrels)	4,489	5,947
Copper:			Phosphate rock	[2] 473	(7)
Mine [2]	*364	*873	Potassium salts (equivalent K_2O)[8]	*1,340,000	*1,280,000
Smelter [5]	[2] 62,244	[4] 145,563	Pyrites, including cupreous pyrites	[2] 383,100	430,495
Feldspar	32,921	49,544	Salt	[2] 1,910,300	[2] 1,966,000
Fluorspar [2]	37,549	33,871	Silver (troy ounces)	[2] 867,459	[4] 1,601,782
Fuel briquets:			Talc and soapstone	[2] 28,214	30,968
Bituminous and anthracite [4]	2,972,000	3,586,000	Tin:		
Lignite	*42,898,000	*44,250,000	Mine (long tons)	*100	*120
Graphite	5,757	5,097	Smelter (long tons)[2]	26	*120
Gypsum [2]	*316,600	*515,300	Zinc:		
Iron ore [6]	[4] 7,276,000	9,112,000	Mine	[2] 25,410	[4] 52,040
Iron and steel:			Smelter [5]	[2] 41,352	[4] 86,916
Pig iron and ferro-alloys [2]	5,630,399	7,659,000			
Steel ingots and castings [4]	5,559,914	9,156,000			
Lead:					
Mine	22,400	40,944			
Smelter [5]	[2] 49,382	[4] 91,372			

[1] Arsenic, bauxite, bismuth, cobalt, fluorspar, gold, and mercury are produced, but data are not available. See also p. 1603.
[2] American-British zones (Bizonal area) only.
[3] American zone only.
[4] Federal Republic only.
[5] Includes scrap.
[6] Exclusive of manganiferous iron ore containing 12- to 30-percent manganese.
[7] Data not available.
[8] Fiscal year ended June 30 of year stated.

GREECE

TABLE 35.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Arsenic, white, smelter	18	13	Magnesite	12,168	25,250
Barite	18,706	15,604	Manganese ore	(2)	1,150
Bauxite	40,183	48,852	Pyrites, including cupreous pyrites	16,236	15,785
Chromite	1,500	3,381	Salt	52,208	(2)
Coal: Lignite (thousand tons)	125	(2)	Talc and soapstone	1,800	(2)
Lead:			Zinc	1,400	1,695
Mine	1,280	2,051			
Smelter	1,166	1,706			

[1] Cement, gypsum, iron ore, molybdenum, silver, and sulfur are produced, but data are not available. See also p. 1603.
[2] Data not available.

HUNGARY

TABLE 36.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	*9,400	*14,000	Iron and steel:		
Bauxite	*500,000	*600,000	Pig iron and ferro-alloys	*350,000	428,000
Cement, hydraulic	(2)	*640,000	Steel ingots and castings	742,345	890,000
Coal:			Lead		(2)
Bituminous (thousand tons)	1,238	*1,380	Manganese ore	*40,000	(2)
Lignite (thousand tons)	9,360	*10,436	Petroleum, crude (thousand barrels)	3,647	3,791
Iron ore	255,240	293,000			

[1] Antimony, arsenic, copper, fuel briquets, gold, lead (smelter), peat, pyrites, salt, and silver are produced. but data are not available. See also p. 1603.
[2] Data not available.

ICELAND

Peat is produced in Iceland, but data are not available.

IRELAND

TABLE 37.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Barite	7,112	(2)	Fuel briquets	*23,400	(2)
Coal (thousand tons)	182	115	Peat	*3,846,800	(2)

[1] Cement, gypsum, phosphate rock, and pyrites are produced, but data are not available. See also p. 1603.
[2] Data not available.

ITALY

TABLE 38.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	33,083	25,631	Lead:		
Antimony	420	330	Mine	26,500	35,000
Arsenic, white, smelter	1,730	[2] 1,050	Smelter	26,734	26,346
Asbestos	13,044	*15,000	Magnesite	1,002	456
Barite	62,234	46,616	Magnesium metal		(4)
Bauxite	153,147	104,852	Manganese ore	24,689	24,219
Cadmium, smelter (kilograms)	47,000	[3] 57,000	Mercury (flasks)	38,233	*44,000
Cement, hydraulic	3,143,808	4,036,501	Nitrogen, fertilizer [5]	100,000	104,330
Coal:			Petroleum, crude (thousand barrels)	71	71
Bituminous and anthracite (thousand tons)	975	1,104	Platinum, refinery (troy ounces)		(4)
Lignite (thousand tons)	904	832	Pyrites, including cupreous pyrites	835,027	866,179
Coke	*1,300,000	1,355,600	Salt	464,456	*580,000
Copper:			Silver (troy ounces)	663,270	*793,545
Mine [3]	90	30	Sulfur, native, crude (long tons)	170,904	*187,000
Smelter	167	30	Talc and soapstone	(4)	68,280
Feldspar	13,469	10,901	Tungsten concentrates, 60% WO_3 basis	4	1
Fluorspar	39,540	17,746	Zinc:		
Gold (troy ounces)	18,422	(4)	Mine	67,328	61,734
Graphite	6,743	4,011	Smelter	26,397	26,612
Iron ore	543,241	520,842			
Iron and steel:					
Pig iron and ferro-alloys	526,072	444,998			
Steel ingots and castings	2,125,147	2,055,499			

[1] Cobalt, fuel briquets, gypsum, magnesium metal, mica, molybdenum, peat, phosphate rock, and potassium salts are produced, but data are not available. See also p. 1603.
[2] January to September, inclusive.
[3] According to the Yearbook of the American Bureau of Metal Statistics.
[4] Data not available.
[5] Fiscal year ended June 30 of year stated.

LUXEMBOURG

TABLE 39.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Cement, hydraulic	102,000	121,000
Iron ore	3,399,274	4,137,327
Iron and steel:		
Pig iron and ferro-alloys	2,626,300	2,371,580
Steel ingots and castings	2,452,844	2,271,858

[1] Gypsum is produced, but data are not available. See also p. 1603.

NETHERLANDS

TABLE 40.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Cement, hydraulic	588,997	564,900
Coal:		
Bituminous (thousand tons)	11,032	11,703
Lignite (thousand tons)	279	*207
Coke	2,239,500	2,474,400
Fuel briquets:		
Bituminous	935,865	992,000
Lignite	62,988	61,000
Iron and steel:		
Pig iron and ferro-alloys	442,000	(2)
Steel ingots and castings	*200,000	*445,000
Nitrogen, fertilizer [3]	65,000	86,080
Petroleum, crude (thousand barrels)	3,122	3,912
Salt	250,417	331,000
Tin, smelter (long tons)	16,402	19,487
Zinc, smelter	13,588	15,614

[1] Peat is produced but data are not available. See also p. 1603.
[2] Data not available.
[3] Fiscal year ended June 30 of year stated.

NORWAY

TABLE 41.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Aluminum smelter	31,041	35,047
Cadmium, smelter (kilograms)	69,000	(2)
Cement, hydraulic	526,187	592,184
Copper:		
Mine	15,112	4,600
Smelter	8,935	9,044
Feldspar (exports)	30,130	21,932
Fluorspar		(2)
Graphite	1,125	(2)
Iron ore	287,992	375,878
Iron and steel:		
Pig iron and ferro-alloys	214,719	230,415
Steel ingots and castings	63,331	72,000
Lead		330
Magnesite	1,740	(2)
Mica (exports)	241	113
Molybdenum	79	70
Nickel		(2)
Nitrogen, fertilizer [3]	82,850	107,500
Peat	343,130	(2)
Pyrites, including cupreous pyrites	735,422	745,367
Silver (troy ounces)	215,410	144,700
Talc and soapstone	60,226	(2)
Tin, smelter (long tons)		(2)
Titanium concentrates:		
Ilmenite	93,322	(2)
Rutile		(2)
Tungsten concentrates, 60 percent WO_3 basis		(2)
Zinc:		
Mine	6,006	6,293
Smelter	42,000	41,040

[1] Barite, beryl, bismuth, gold, and lead (smelter) are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Fiscal year ended June 30 of year stated.

POLAND

TABLE 42.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Cement, hydraulic	1,823,857	2,200,000	Iron ore	602,000	[3] 506,801
Coal:			Iron and steel:		
Bituminous (thousand tons)	70,262	69,900	Pig iron and ferro-alloys	1,113,000	(2)
Lignite (thousand tons)	5,040	*4,585	Steel ingots and castings	1,954,000	2,297,300
Coke	5,183,300	5,815,700	Lead, smelter	16,874	*17,000
Fuel briquets:			Nitrogen, fertilizer [4]	41,140	55,080
Bituminous	717,508	796,000	Petroleum, crude (thousand barrels)	*1,039	*965
Lignite	113,633	175,000	Salt	725,774	800,000
Gypsum	14,183	(2)	Zinc, smelter	87,089	(2)

[1] Cadmium, magnesite, peat, phosphate rock, potassium salts, pyrites, and silver are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] January to September, inclusive.
[4] Fiscal year ended June 30 of year stated.

PORTUGAL

TABLE 43.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	38	(2)	Manganese ore	280	508
Arsenic, white, smelter	(2)	[3] 228	Mica	--------	(2)
Barite	406	(2)	Peat	1,502	266
Beryllium concentrates	*10	*20	Pyrites, including cupreous pyrites	561,136	622,925
Cement, hydraulic	496,800	518,400	Silver (troy ounces)	35,366	(2)
Coal:			Tin:		
Bituminous and anthracite (thousand tons)	387	444	Mine (long tons) [4]	750	820
Lignite (thousand tons)	103	111	Smelter (long tons)	282	*240
Fuel briquets	49,681	(2)	Titanium concentrates: Ilmenite	155	680
Gold (troy ounces)	11,799	(2)	Tungsten concentrates, 60 percent WO_3 basis	2,944	2,700
Gypsum	42,842	(2)			

[1] Asbestos, chromite, feldspar, iron ore, lead (smelter), and salt are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] January to June, inclusive.
[4] Excluding content of mixed concentrates.

RUMANIA

TABLE 44.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Cement, hydraulic	452,000	560,000	Iron and steel:		
Coal:			Pig iron and ferro-alloys	*80,000	*280,000
Bituminous and anthracite (thousand tons)	} 2,631	*191	Steel ingots and castings	*200,000	*265,000
Lignite (thousand tons)	}	2,378	Lead	--------	(2)
Gold (troy ounces)	90,000	120,000	Manganese ore	*47,000	*65,000
Iron ore	*140,000	*200,000	Petroleum, crude (thousand barrels)	*34,600	*33,700

[1] Bauxite, beryl, bismuth, coke, copper (smelter), feldspar, fuel briquets, gypsum, lead (smelter), mercury, mica, molybdenum, phosphate rock, pyrites, salt, silver, talc, and zinc (smelter) are produced, but no data are available. See also p. 1603.
[2] Data not available.

SPAIN

TABLE 45.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Aluminum, smelter	523	(2)
Antimony (includes Spanish Morocco)	132	150
Arsenic, white, smelter	573	(2)
Asbestos	35	(2)
Barite	14,153	(2)
Bauxite	6,805	10,293
Bismuth (kilograms)	24,269	(2)
Cement, hydraulic	2,330,850	2,227,675
Coal:		
Bituminous and anthracite (thousand tons)	10,627	10,641
Lignite (thousand tons)	1,400	1,321
Coke	848,375	969,413
Copper:		
Mine [3]	5,503	6,702
Smelter	18,640	9,016
Feldspar	9,807	(2)
Fluorspar	30,250	61,915
Fuel briquets	1,005,285	1,140,959
Gold (troy ounces)	11,375	30,318
Graphite	241	(2)
Gypsum	1,421,899	1,293,552
Iron ore	1,630,728	1,811,112
Iron and steel:		
Pig iron and ferro-alloys	537,240	632,438
Steel ingots and castings	623,696	648,517
Lead:		
Mine	27,300	29,500
Smelter	20,926	27,364
Magnesite	9,897	6,691
Manganese ore	18,525	*19,000
Mercury (flasks)	22,684	32,289
Mica	11	9
Phosphate rock	23,012	23,093
Potassium salts (equivalent K_2O)	151,185	(2)
Pyrites, including cupreous pyrites	1,463,912	1,132,793
Salt:		
Rock salt	292,881	(2)
Other salt	696,600	(2)
Silver (troy ounces)	339,396	514,090
Sulfur, native (long tons)	2,500	5,000
Talc and soapstone	29,984	38,208
Tin:		
Mine (long tons)	261	*300
Smelter (long tons)	483	718
Titanium concentrates: Ilmenite	181	311
Tungsten concentrates, 60 percent WO_3 basis	876	888
Zinc:		
Mine	42,350	44,860
Smelter	21,203	19,551

[1] Beryl and cobalt are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] According to the Yearbook of the American Bureau of Metal Statistics.

SWEDEN

TABLE 46.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Aluminum, smelter	3,279	4,000
Arsenic, white, smelter	[2] 19,100	(3)
Barite	1,914	(3)
Bismuth, smelter (kilograms)	--------	(3)
Cement, hydraulic	1,486,450	1,700,000
Chromite	--------	(3)
Coal (thousand tons)	374	311
Cobalt	--------	(3)
Coke	73,800	82,600
Copper:		
Mine	14,835	16,273
Smelter	17,180	14,359
Feldspar	38,687	(3)
Fluorspar	4,303	(3)
Gold (troy ounces)	71,889	80,280
Graphite	--------	(3)
Gypsum	--------	(3)
Iron ore	13,287,118	*14,000,000
Iron and steel:		
Pig iron and ferro-alloys	803,586	801,000
Steel ingots and castings	1,256,917	1,366,400
Lead:		
Mine	23,579	23,900
Smelter	6,228	10,757
Manganese ore	8,417	(3)
Mica	64	(3)
Nickel	--------	(3)
Peat	375,000	(3)
Phosphate rock	1,441	(3)
Pyrites, including cupreous pyrites	392,033	(3)
Silver (troy ounces)	1,137,943	1,140,708
Talc and soapstone	11,703	(3)
Tungsten concentrates, 60 percent WO_3 basis	317	468
Zinc	31,918	31,624

[1] Fuel briquets and molybdenum are produced, but data are not available. See also p. 1603.
[2] Includes 7,900 metric tons crude (92.99 percent As_2O_3).
[3] Data not available.

SVALBARD (SPITSBERGEN)

Production of coal in Svalbard (Spitsbergen) totaled 437,000 metric tons in 1948 and 500,000 tons (preliminary figure) in 1949.

SWITZERLAND

TABLE 47.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	18, 960	22, 000	Iron ore	*75, 000	40, 000
Asbestos	------------	(2)	Iron and steel:		
Barite	------------	(2)	Pig iron and ferro-alloys	*30, 000	*32, 000
Cement, hydraulic	*1, 000, 000	*950, 000	Steel ingots and castings	80, 000	*120, 000
Gypsum	*165, 000	*80, 000	Salt	112, 218	(2)

[1] Coal is produced, but data are not available. See also p. 1603.
[2] Data not available.

TURKEY (IN EUROPE)

Data on output of Turkey in Europe are included with those of Turkey in Asia.

U. S. S. R. (IN EUROPE AND ASIA)

TABLE 48.—Mineral production, 1948–49, in metric tons (all data estimated)

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	140, 000	(2)	Lead, smelter	75, 000	90, 000
Bauxite	500, 000	(2)	Magnesium metal	5, 000	5, 000
Chromite	600, 000	350, 000	Nickel	25, 000	25, 000
Coal (thousand tons)	201, 000	226, 000	Petroleum, crude (thousand barrels)	225, 000	240, 000
Coke	20, 000, 000	24, 000, 000	Platinum (troy ounces)	125, 000	100, 000
Copper, smelter	180, 000	200, 000	Salt	(3)	(3)
Gold (troy ounces)	7, 000, 000	7, 000, 000	Tungsten concentrates, 60 percent WO_3 basis	1, 500	1, 500
Iron and steel:			Zinc, smelter	110, 000	110, 000
Pig iron and ferro-alloys	12, 770, 000	15, 000, 000			
Steel ingots and castings	18, 300, 000	21, 600, 000			

[1] Antimony, arsenic, asbestos, barite, beryl, bismuth, cadmium, cement, copper, corundum, diamonds, feldspar, fluorspar, fuel briquets, graphite, gypsum, iron ore, lead, magnesite, manganese ore, mercury, mica, molybdenum, peat, phosphate rock, potassium salts, pyrites, pyrophyllite, silver, native sulfur, talc, and zinc are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Exceeds 4,000,000 tons annually.

UNITED KINGDOM

TABLE 49.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	30, 510	30, 832	Lead:		
Bauxite	------------	(2)	Mine	2, 312	2, 122
Cadmium, smelter (kilograms)	115, 769	102, 662	Smelter	*2, 312	*2, 122
Cement, hydraulic	8, 657, 762	9, 364, 000	Magnesium metal [5]	3, 500	5, 100
Coal:			Manganese ore	------------	(2)
Great Britain (thousand tons)	211, 772	217, 161	Nitrogen, fertilizer [6]	258, 000	289, 800
Northern Ireland:			Petroleum, crude (thousand barrels)	323	338
Bituminous (thousand tons)	1.	(2)	Salt	13, 245	(2)
Lignite (thousand tons)	(3)	(2)	Silver (troy ounces)	25, 000	(2)
Coke	15, 584, 175	15, 739, 630	Talc and soapstone	(2)	2, 621
Fluorspar	71, 124	(2)	Tin:		
Fuel briquets	1, 475, 305	1, 536, 268	Mine (long tons)	1, 281	1, 217
Gypsum	1, 175, 570	(2)	Smelter (long tons) [7]	31, 602	28, 384
Iron ore [4]	13, 299, 282	13, 620, 000	Tungsten concentrates, 60 percent WO_3 basis	*70	30
Iron and steel:			Zinc, smelter	73, 138	65, 124
Pig iron and ferro-alloys	9, 425, 286	9, 652, 881			
Steel ingots and castings	15, 115, 369	15, 801, 600			

[1] Arsenic, barite, bismuth, chromite, feldspar, and pyrites are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Less than 1,000 tons.
[4] Exclusive of bog ore, used mainly for gas purification.
[5] Includes secondary metal.
[6] Fiscal year ended June 30 of year stated.
[7] Includes production from imported scrap.

YUGOSLAVIA

TABLE 50.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	2,900	(2)	Iron and steel:		
Bauxite	*190,000	(2)	Pig iron and ferro-alloys	172,000	*225,000
Cement, hydraulic	1,188,000	(2)	Steel ingots and castings	*368,000	*390,000
Coal (thousand tons)	11,500	*12,900	Lead	41,700	36,300
Copper, smelter	*52,500	*34,000	Petroleum, crude (thousand barrels)	385	440

[1] Antimony, barite, bismuth, chromite, copper (mine), fuel briquets, gold, gypsum, iron ore, lead (smelter), magnesite, manganese ore, mercury, molybdenum, pyrites, salt, silver, and zinc are produced, but data are not available. See also p. 1603.
[2] Data not available.

AFRICA

ALGERIA

TABLE 51.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	787	1,288	Lead	1,044	1,057
Barite	16,681	16,874	Mercury (flasks)	381	102
Cement, hydraulic	129,867	128,075	Phosphate rock	670,591	645,906
Coal (thousand tons)	226	257	Pyrites, including cupreous pyrites	35,900	32,385
Fuel briquets	77,820	56,616	Salt	13,038	(2)
Gypsum	33,258	(2)	Zinc	4,860	6,440
Iron ore	1,871,522	2,538,518			

[1] Asbestos, lignite, and silver are produced, but data are not available. See also p. 1603.
[2] Data not available.

ANGLO-EGYPTIAN SUDAN

TABLE 52.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Gold (troy ounces)	3,579	4,114
Gypsum	3,045	(2)
Salt	36,238	(2)

[1] Magnesite is produced, but data are not available. See also p. 1603.
[2] Data not available

ANGOLA

TABLE 53.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Copper	394	800	Manganese ore	400	18,600
Diamonds (metric carats)	795,509	769,981	Mica	108	57
Gold (troy ounces)	443	319	Salt	53,423	(2)

[1] Gypsum is produced, but data are not available. See also p. 1603
[2] Data not available.

BECHUANALAND

TABLE 54.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949
Gold (troy ounces)	1,507	256
Silver (troy ounces)	233	23

BELGIAN CONGO

TABLE 55.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Bismuth (kilograms)	456	(2)	Manganese ore	12,765	[3] 16,286
Cadmium, smelter (kilograms)	18,000	[3] 27,000	Palladium, refinery (troy ounces)	209	(2)
Cement, hydraulic	*126,942	*156,914	Salt	*1,000	(2)
Coal (thousand tons)	117	(2)	Silver (troy ounces)	3,805,619	4,549,330
Cobalt	4,322	4,350	Tin:		
Copper, smelter	155,481	141,399	Mine (long tons)	13,700	13,900
Diamonds (metric carats)	5,824,567	9,649,896	Smelter (long tons)	3,875	3,247
Gold (troy ounces)	299,774	333,853	Tungsten, concentrates, 60% WO_3 basis	236	276
Iron ore	----------	(2)	Zinc	41,880	51,130
Lead	500	72			

[1] Copper (mine) and gypsum are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Exports.

BRITISH SOMALILAND

Salt is produced in British Somaliland, but data are not available.

CANARY ISLANDS

Salt is produced in the Canary Islands, but data are not available.

CAPE VERDE ISLANDS

Salt is produced in the Cape Verde Islands, but data are not available.

EGYPT

TABLE 56.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Asbestos	1,625	120	Petroleum, crude (thousand barrels)	13,398	15,927
Barite	--------	30	Phosphate rock	377,005	350,969
Cement, hydraulic	768,283	*800,000	Salt (exports)	359,823	[3] 343,416
Chromite	191	(2)	Talc and soapstone	5,521	5,000
Feldspar	--------	(2)	Titanium concentrates: Ilmenite	1,034	(2)
Gold (troy ounces)	3,853	(2)	Tungsten concentrates, 60% WO_3 basis	15	(2)
Graphite	50	(2)			
Gypsum	95,243	(2)			
Manganese ore	59,919	138,000			

[1] Iron ore, magnesite, pyrites, and native sulfur are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] January to September, inclusive.

ERITREA

Cement (hydraulic), feldspar, gold, mica, potassium salts, and common salt are produced, but data are not available.

ETHIOPIA

TABLE 57.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Cement, hydraulic	*8,000	*8,000
Gold (troy ounces)	41,595	45,102
Platinum (exports) (troy ounces)	460	355

[1] Gypsum, mica, salt, and potassium salts are produced, but data are not available. See also p. 1603.

FRENCH CAMEROON

TABLE 58.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949
Gold (troy ounces)	10,706	8,938
Tin (long tons)	102	73
Titanium concentrates: Rutile	(1)	403

[1] Data not available.

FRENCH EQUATORIAL AFRICA

TABLE 59.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Diamonds (metric carats)	118,800	123,000	Lead	2,600	700
Gold (troy ounces)	63,715	57,273	Zinc		40

FRENCH MOROCCO

TABLE 60.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	411	600	Lead	28,852	37,489
Asbestos	399	402	Manganese ore	214,412	233,830
Beryllium concentrates	51	211	Mica	144	54
Cement, hydraulic	262,232	264,000	Molybdenum		(2)
Coal (thousand tons)	290	347	Petroleum, crude (thousand barrels)	100	136
Cobalt	278	209	Phosphate rock	3,226,700	3,693,000
Copper	449	360	Pyrites, including cupreous pyrites		200
Fluorspar		445	Salt, rock	15,566	34,100
Fuel briquets	22,959	*15,000	Zinc	1,910	2,615
Graphite	284	72			
Gypsum	(2)	15,425			
Iron ore	301,300	356,800			

[1] Gold, silver, salt (other than rock), and talc are produced, but data are not available. See also p. 1603.
[2] Data not available.

FRENCH SOMALILAND

Production of salt in French Somaliland totaled approximately 60,000 metric tons in both 1948 and 1949.

FRENCH WEST AFRICA

TABLE 61.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Diamonds (metric carats)	77,970	94,996
Gold (troy ounces)	20,512	46,381
Titanium concentrates [2]	3,690	8,338

[1] Bauxite, iron ore, and salt are produced, but data are not available. See also p. 1603.
[2] Ilmenite from Senegal.

GOLD COAST

TABLE 62.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Bauxite (exports)	133,055	*134,000	Manganese ore (exports)	640,088	[2] 285,501
Diamonds (metric carats)	*850,000	432,530	Silver (exports) (troy ounces)	*41,000	38,887
Gold (exports) (troy ounces)	672,388	657,595			

[1] Salt is produced, but data are not available. See also p. 1603.
[2] January to May, inclusive.

ITALIAN SOMALILAND (FORMERLY)

Salt is produced in Italian Somaliland, but data are not available.

KENYA

TABLE 63.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Asbestos	510	716	Mica	(2)	4
Feldspar	10	20	Salt	16,813	(2)
Gold (troy ounces)	23,429	20,072	Silver (troy ounces)	3,184	2,279
Gypsum	1,016	181	Talc and soapstone	322	590
Magnesite	(2)	20			

[1] Beryl is produced, but data are not available. See also p. 1603.
[2] Data not available.

LIBERIA

Production of gold in Liberia totaled 13,797 troy ounces in 1948 and 14,656 ounces in 1949.

LIBYA

Production of salt in Libya totaled 6,140 metric tons in 1948. Data for 1949 are not available.

MADAGASCAR

TABLE 64.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Asbestos	(3)	(3)	Graphite (exports)	8,438	9,767
Corundum	4	(3)	Mica	507	969
Gold (troy ounces)	2,095	1,663			

[1] Beryl, cement, coal, feldspar, salt, and talc are produced, but data are not available. See also p. 1603.
[2] Less than 1 ton.
[3] Data not available.

MALTA

Production of salt in Malta totaled 1,869 metric tons in 1948. Data for 1949 are not available.

MAURITIUS

Salt is produced in Mauritius, but data are not available.

MOZAMBIQUE

TABLE 65.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Bauxite	2,960	(2)	Graphite	120	(2)
Beryllium concentrates	81	(2)	Mica	1	(2)
Cement, hydraulic	35,858	(2)	Silver (troy ounces)	712	(2)
Coal (thousand tons)	16	(2)	Tin (long tons)	*1	--------
Gold (troy ounces)	5,427	(2)			

[1] Corundum and salt are produced, but data are not available. See also p. 1603.
Data not available.

NIGERIA

TABLE 66.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Coal (thousand tons)	618	559	Tin (long tons)	9,237	8,824
Gold (troy ounces)	2,899	2,515	Tungsten concentrates, 60 percent WO_3 basis	4	5
Lead	--------	(2)			
Silver (troy ounces)	4,270	484			

[1] Salt is produced, but data are not available. See also p. 1603.
[2] Data not available.

NORTHERN RHODESIA

TABLE 67.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Cobalt [2]	367	402	Mica	--------	3
Copper:			Silver (troy ounces)[4]	145,865	134,920
Mine	226,472	259,084	Tin (long tons)	--------	7
Smelter	217,044	263,491	Vanadium	173	153
Gold (troy ounces)[3]	1,180	1,186	Zinc, smelter	22,526	23,217
Iron ore	149	1,749			
Lead:					
Mine	11,700	14,169			
Smelter	13,229	14,189			

[1] Manganese ore is produced, but data are not available. See also p. 1603.
[2] Fiscal year ended June 30 of year stated.
[3] Included is yield from Nkana-mine refinery slimes accumulated during the war: 999 ounces in 1948 and 972 ounces in 1949.
[4] Recovered from an accumulation of refinery slimes.

NYASALAND

Nyasaland may have produced graphite in 1948–49 and corundum in 1949, but data are not available. No corundum was produced in 1948.

SEYCHELLES ISLANDS

Exports of phosphate rock (guano) from the Seychelles Islands totaled 21,924 metric tons in 1948 and 14,243 tons in 1949.

SIERRA LEONE

TABLE 68.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Chromite	7,886	(2)	Iron ore	967,888	(2)
Diamonds (metric carats)	465,518	494,119	Platinum (troy ounces)	109	(2)
Gold (troy ounces)	2,193	2,160			

[1] Silver is produced, but data are not available. See also p. 1603.
[2] Data not available.

SOUTHERN RHODESIA

TABLE 69.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	8	34	Magnesite	5,722	7,640
Arsenic, white, smelter	283	148	Manganese ore	998	166
Asbestos	62,502	72,246	Mica	293	303
Barite	51	488	Phosphate rock	--------	67
Chromite	230,703	243,506	Pyrites, including cupreous pyrites	13,224	16,968
Coal (thousand tons)	1,695	1,918	Silver (troy ounces)	81,404	84,495
Coke	79,362	(2)	Tin:		
Corundum	114	--------	Mine (long tons)	105	70
Fluorspar	12	239	Smelter (long tons)	127	*120
Gold (troy ounces)	514,440	528,180	Tungsten concentrates, 60 percent WO_3 basis	80	26
Iron ore	30,478	51,485			
Lead	--------	83			

[1] Beryl, copper (mine), and salt are produced, but data are not available. See also p. 1603.
[2] Data not available.

SOUTH-WEST AFRICA

TABLE 70.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Barite	--------	48	Phosphate rock	1,038	957
Beryllium concentrates	90	239	Salt:		
Cadmium (kilograms) [2]	431,000	757,818	Rock salt	4,207	[3] 1,433
Copper, mine	8,270	9,622	Other salt	10,612	[3] 10,190
Diamonds (metric carats)	200,691	280,134	Silver (troy ounces)	323,647	642,500
Gold (troy ounces)	455	32	Tin (long tons)	111	129
Graphite	1,627	2,264	Tungsten concentrates, 60 percent WO_3 basis	12	6
Lead:			Vanadium	187	165
Mine	25,363	31,976			
Smelter	82	--------			

[1] Fluorspar is produced, but data are not available. See also p. 1603.
[2] Cadmium content of ore and flue dust exported for treatment elsewhere.
[3] January to September, inclusive.

SPANISH MOROCCO

TABLE 71.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	240	150	Gypsum	1,829	(2)
Graphite	25	--------	Iron ore	904,330	943,539

[1] Manganese ore has been produced, but recent data are not available. See also p. 1603.
[2] Data not available.

SWAZILAND

TABLE 72.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Asbestos	29,421	30,814	Silver (troy ounces)	124	120
Barite	98	104	Tin (long tons)	20	32
Gold (troy ounces)	3,110	2,841			

TANGANYIKA

TABLE 73.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Diamonds (metric tons)	148,169	191,787	Silver (exports) (troy ounces)	25,010	27,631
Gold (exports) (troy ounces)	57,557	68,989	Tin (exports) (long tons)	97	110
Mica	[2] 75	99	Tungsten concentrates (exports), 60 percent WO_3 basis	(4)	42
Phosphate rock	313	157			
Salt	12,073	(3)			

[1] Beryl, corundum, and talc are produced, but data are not available. See also p. 1603.
[2] Exports.
[3] Data not available.
[4] Less than 1 ton.

TUNISIA

TABLE 74.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Barite	230	630	Phosphate rock	1,863,710	1,441,918
Cement, hydraulic	162,000	167,631	Pyrites, including cupreous pyrites	3,220	2,920
Coal: Lignite (thousand tons)	71	*47	Salt	98,029	(1)
Fluorspar	525	352	Silver (troy ounces)	(1)	56,638
Fuel briquets	45,746	43,153	Zinc	1,851	2,969
Gypsum	19,130	22,066			
Iron ore	690,200	711,894			
Lead:					
Mine	13,481	14,989			
Smelter	18,060	19,498			

[1] Data not available.

UGANDA

TABLE 75.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Beryllium concentrates	44	34	Tin (exports) (long tons)	190	131
Gold (exports) (troy ounces)	1,158	650	Tungsten concentrates, 60 percent WO_3 basis	126	183
Mica	2	2			
Salt	7,011	(2)			

[1] Asbestos, bismuth, and silver are produced, but data are not available. See also p. 1603.
[2] Data not available.

UNION OF SOUTH AFRICA

TABLE 76.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Antimony	3,780	4,100
Arsenic, white, smelter	13	(2)
Asbestos	41,490	[3] 46,028
Barite	1,734	2,222
Beryllium concentrates	----------	223
Bismuth (kilograms)	437	5,045
Cement, hydraulic	1,308,000	1,363,200
Chromite	412,783	326,976
Coal (thousand tons)	24,017	[4] 25,010
Copper:		
Mine	29,450	30,189
Smelter	28,993	29,717
Corundum	2,537	2,464
Diamonds:		
Lode (metric carats)	*930,000	964,266
Alluvial [5] (metric carats)	*270,000	289,756
Feldspar	2,101	3,259
Fluorspar	3,754	5,107
Gold (troy ounces)	11,584,849	11,705,048
Graphite	172	[3] 83
Gypsum (sales)	78,625	88,232
Iron ore	1,163,723	1,248,000
Iron and steel:		
Pig iron and ferro-alloys	651,100	708,400
Steel ingots and castings	596,983	631,516
Lead	----------	(2)
Magnesite	10,660	10,487
Manganese ore	276,393	655,181
Mica	1,362	1,066
Nickel	458	618
Phosphate rock	39,656	56,471
Platinum-group metals (troy ounces):		
Platinum-group metals from platinum ores	68,926	87,300
Osmiridium from gold ores	5,520	6,031
Pyrites, including cupreous pyrites	35,992	35,527
Silver (troy ounces)	1,170,951	1,159,375
Talc, pyrophyllite and soapstone	4,897	5,061
Tin:		
Mine (long tons)	457	471
Smelter (long tons)	554	595
Tungsten concentrates, 60 percent WO_3 basis	151	416

[1] Coke and salt are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] January to September, inclusive.
[4] Local sales and exports.
[5] Includes an estimate of 100,000 carats for State Mines of Namaqualand.

ASIA

ADEN

Production of salt in Aden totaled 275,408 metric tons in 1948 and 308,302 tons in 1949.

AFGHANISTAN

Coal and salt are produced in Afghanistan, but data are not available. Planned output of coal in 1948 was 15,000 metric tons.

BAHREIN ISLAND

Bahrein Island produced 10,915,000 barrels of crude petroleum in 1948 and 10,985,000 barrels in 1949.

BRITISH BORNEO

TABLE 77.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Gold (troy ounces) [2]	599	(3)
Petroleum, crude (thousand barrels)	20,120	25,108
Phosphate rock	427	508

[1] Coal and silver are produced, but data are not available. See also p. 1603.
[2] Sarawak only.
[3] Data not available.

BURMA

TABLE 78.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	*110	(2)	Silver (troy ounces)	*450,000	--------
Gold (troy ounces)	230	(2)	Tin (long tons)	1,147	1,781
Lead, smelter	7,570	2,318	Tungsten concentrates, 60 percent WO_3 basis	1,824	740
Petroleum, crude (thousand barrels)	360	316			

[1] Bismuth, iron ore, lead (mine), manganese ore, and salt are produced, but data are not available. See also p. 1603.
[2] Data not available.

CEYLON

TABLE 79.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949
Graphite (exports)	14,221	12,437
Gypsum	26	37
Salt	78,300	(1)

[1] Data not available.

CHINA (EXCEPT FORMOSA)

TABLE 80.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	3,251	(2)	Magnesium metal	------------	(2)
Cement, hydraulic [3]	(2)	*216,000	Manganese ore	*22,000	(2)
Coal, bituminous and anthracite (thousand tons)	*8,720	*16,000	Mercury (flasks)	290	(2)
Coke	*50,000	*270,000	Petroleum, crude (thousand barrels)	533	730
Graphite	------------	(2)	Pyrites (including cupreous pyrites)	42,907	(2)
Gypsum	*55,000	(2)	Salt	*2,480,000	*2,000,000
Iron ore	* [4] 246,600	(2)	Tin, smelter (long tons)	[4] 1,632	(2)
Iron and steel:			Tungsten concentrates, 60 percent WO_3 basis	[4] 9,327	5,000
Pig iron and ferro-alloys	* [5] 47,400	* [3] 172,000	Zinc, smelter	330	(2)
Steel ingots and castings	11,400	* [3] 100,000			
Lead, smelter	834	(2)			

[1] Aluminum, arsenic, asbestos, barite, bismuth, coal (lignite), cobalt, copper, feldspar, fluorspar, gold, magnesite, mica, molybdenum, phosphate rock, potassium salts, silver, native sulfur, talc, and tin (mine) are produced but data are not available. See also p. 1603.
[2] Data not available.
[3] Manchuria only.
[4] Only production reported by National Resources Commission.
[5] Excludes Manchuria.

CHINA—FORMOSA

TABLE 81.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Aluminum, smelter	2,509	1,311	Gold (troy ounces)	17,668	16,607
Cement, hydraulic	236,000	291,000	Petroleum, crude (thousand barrels)	23	22
Coal (thousand tons)	1,629	1,614	Salt	*360,000	250,000
Coke	31,841	35,971	Silver (troy ounces)	7,042	4,836
Copper:			Sulfur, native (long tons)	1,719	344
Mine	1,183	(1)			
Smelter	472	(1)			

[1] Data not available.

CHRISTMAS ISLAND

Exports of phosphate rock from Christmas Island totaled 108,311 metric tons in 1948 and 255,236 tons in 1949. This Christmas Island is south of Java, not the Christmas Island south of Hawaii.

CYPRUS

TABLE 82.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Asbestos	8,106	[2] 11,276	Magnesite (exports)	1	20
Chromite (exports)	6,899	14,875	Pyrites, including cupreous pyrites	589,772	942,808
Copper (exports)	15,735	23,936			
Gypsum (exports)	19,500	25,788			

[1] Salt is produced, but data are not available. See also p. 1603.
[2] Exports.

FRENCH INDOCHINA

TABLE 83.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Asbestos		(1)	Manganese ore		(1)
Cement, hydraulic	97,259	154,000	Molybdenum		(1)
Chromite		(1)	Salt	64,000	(1)
Coal, bituminous and anthracite	359	385	Tin:		
Fuel briquets	12,000	(1)	Mine (long tons)	30	*60
Lead, smelter		(1)	Smelter (long tons)	32	*60

[1] Data not available.

HONG KONG

Production of hydraulic cement in Hong Kong totaled 52,200 metric tons in 1948 and 58,700 tons in 1949. Silver is produced, but data are not available.

INDIA

TABLE 84.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	3,421	3,547	Lead, smelter	554	593
Asbestos	28	(2)	Magnesite	49,103	*45,000
Barite	22,691	(2)	Manganese ore	534,316	[3] 551,828
Bauxite	20,995	(2)	Mica (exports)	18,384	*20,000
Cement, hydraulic	1,577,831	2,135,737	Nitrogen, fertilizer [4]	7,280	12,630
Chromite	22,917	(2)	Petroleum, crude (thousand barrels)	1,875	1,894
Coal (thousand tons)	30,303	*31,760	Phosphate rock	1,132	(2)
Coke	1,665,797	(2)	Salt:		
Copper:			Rock salt	4,123	*2,800,000
Mine	6,316	6,305	Other salt	2,300,882	
Smelter	5,957	6,721	Silver (troy ounces)	12,797	(2)
Corundum	284	(2)	Talc and soapstone	18,291	(2)
Feldspar	1,003	(2)	Titanium concentrates:		
Fuel briquets		(2)	Ilmenite	233,096	(2)
Gold (troy ounces)	180,430	160,902	Rutile	129	(2)
Graphite	1,675	(2)			
Iron ore	2,321,255	(2)			
Iron and steel:					
Pig iron and ferro-alloys	1,494,431	1,596,833			
Steel ingots and castings	1,224,700	1,264,124			

[1] Beryl, diamonds, fluorspar, potassium salts, pyrites, and native sulfur are produced but data are not available. See also p. 1603.
[2] Data not available.
[3] Exports.
[4] Fiscal year ended June 30 of year stated.

INDONESIA

TABLE 85.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Bauxite	437,822	678,138	Salt	130,000	(2)
Cement, hydraulic	37,751	(2)	Tin.		
Coal (thousand tons)	[3] 537	[3] 590	Mine (long tons)	30,562	28,965
Copper	(2)		Smelter (long tons)	136	126
Fuel briquets	9,420	25,323	Tungsten concentrates, 60% WO_3 basis		(2)
Manganese ore		(2)			
Petroleum, crude (thousand barrels)	31,900	44,932			

1 Silver and sulfur are produced but data are not available. See also p. 1603.
2 Data not available.
3 Excludes production of Ombilin mines in Sumatra.

IRAN

TABLE 86.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Cement, hydraulic	[2] 64,795	(3)
Petroleum, crude (thousand barrels)	190,384	204,712

1 Arsenic, chromite, coal, manganese ore, native sulfur, and salt are produced, but data are not available. See also p. 1603.
2 Fiscal year ended Mar. 20 of year following that stated.
3 Data not available.

IRAQ

TABLE 87.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Cement		[2] 7,007
Petroleum, crude (thousand barrels)	26,115	31,000
Salt	14,000	(3)

1 Gypsum is produced, but data are not available. See also p. 1603.
2 Initial output October 1949.
3 Data not available.

ISRAEL—ARAB PALESTINE

TABLE 88.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Cement, hydraulic [2]	159,865	241,393
Potassium salts (equivalent K_2O) [3]	29,700	

1 Gypsum, phosphate rock, and salt are produced, but data are not available. See also p. 1603.
2 Israel only.
3 Fiscal year ended June 30 of year stated.

JAPAN

TABLE 89.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	6,965	21,218	Iron and steel:		
Antimony	124	158	Pig iron and ferro-alloys	836,455	1,602,200
Arsenic, white, smelter	1,765	(2)	Steel ingots and castings	1,713,828	3,111,400
Asbestos	4,809	5,456	Lead:		
Barite	3,404	9,322	Mine	6,700	9,106
Bismuth, smelter (kilograms)	23,327	*25,000	Smelter	10,197	12,619
Cadmium, smelter (kilograms)	18,874	(2)	Manganese ore	48,091	92,947
Cement, hydraulic	1,848,000	3,274,572	Mercury (flasks)	1,689	2,461
Chromite	9,340	(2)	Molybdenum	1	(3)
Coal:			Nitrogen, fertilizer [6]	200,520	274,070
Bituminous and anthracite (thousand tons)	33,725	37,969	Petroleum, crude (thousand barrels)	1,122	1,353
Lignite (thousand tons)	2,552	*2,095	Phosphate rock	3,590	684
Cobalt	(3)	(3)	Pyrites, including cupreous pyrites	1,138,782	1,535,082
Coke	1,932,000	2,580,000	Salt	339,668	395,676
Copper:			Silver (troy ounces)	2,185,672	2,887,265
Mine	25,765	32,741	Sulfur, native (long tons)	39,962	61,493
Smelter	54,330	74,037	Talc, pyrophyllite, and soapstone	243,737	262,433
Feldspar [4]	25,077	20,055	Tin:		
Fluorspar	68	960	Mine (long tons)	118	189
Fuel briquets	577,501	355,366	Smelter (long tons)	145	479
Gold (troy ounces)	69,180	84,532	Tungsten concentrates, 60 percent WO_3 basis	9	20
Graphite	9,137	5,299	Zinc:		
Gypsum	113,754	117,123	Mine	30,070	39,880
Iron ore [5]	561,063	779,674	Smelter	21,200	32,318

[1] Potassium salts are produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Less than 1 ton.
[4] In addition, the following tonnages of aplite and other feldspatic rock were produced: 1948—35,840; 1949—50,943.
[5] Includes iron-sand production as follows: 1948—2,588 tons; 1949—23,724 tons.
[6] Fiscal year ended June 30 of year stated.

KOREA (SOUTH)

TABLE 90.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Aluminum, smelter	*[2] 1,300	(3)	Gold (troy ounces)	3,466	3,419
Barite	--------	(3)	Graphite	15,454	40,671
Bismuth (kilograms)	104,000	173,420	Lead	300	80
Cement	17,350	24,132	Magnesium metal	--------	(3)
Coal:			Molybdenum	2	11
Bituminous and anthracite (thousand tons)	799	1,066	Nitrogen, fertilizer [4]	10,000	20,000
Lignite (thousand tons)	68	60	Salt	89,979	188,812
Coke	10,971	4,004	Silver (troy ounces)	38,506	18,962
Copper:			Talc, pyrophyllite, and soapstone	72	2,773
Mine	66	28	Tungsten concentrates, 60 percent WO_3 basis	*[2] 2,245	*[2] 2,448
Smelter	514	808	Zinc	180	(3)
Fluorspar	--------	1,230			
Fuel briquets	76,724	168,358			

[1] Arsenic, lead (smelter), manganese ore, phosphate rock, and steel are produced but data are not available. See also p. 1603.
[2] Including North Korea.
[3] Data not available.
[4] Fiscal year ended June 30 of year stated. Data cover North Korea only.

KUWAIT

Production of crude petroleum in Kuwait totaled 46,500,000 barrels in 1948 and 90,000,000 barrels in 1949.

MALAYA

TABLE 91.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Coal (thousand tons)	381	393	Titanium concentrates: Ilmenite	12,909	20,03
Gold (troy ounces)	10,212	13,617	Tungsten concentrates, 60 percent WO_3 basis	87	6
Iron ore	651	8,525			
Tin:					
Mine (long tons)	44,815	54,910			
Smelter (long tons)	49,707	62,737			

[1] Graphite and silver are produced, but data are not available. See also p. 1603.

PAKISTAN

TABLE 92.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony		(2)	Gypsum	(2)	*16,25
Cement, hydraulic	327,168	(2)	Petroleum, crude (thousand barrels)	490	74
Chromite	17,707	*15,000	Salt [3]	156,378	223,50
Coal (thousand tons)	250	*325			
Fuel briquets	4,596	(2)			

[1] Talc is produced, but data are not available. See also p. 1603.
[2] Data not available.
[3] Punjab only.

PHILIPPINES

TABLE 93.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Cement, hydraulic	120,384	206,202	Gypsum	818	2,71
Chromite	256,854	246,744	Iron ore	18,289	370,17
Coal (thousand tons)	88	123	Manganese ore	25,565	26,28
Copper	3,350	7,007	Silver (troy ounces)	150,760	218,41
Gold (troy ounces)	209,225	287,844			

[1] Pig iron, phosphate rock, and salt are produced, but data are not available. See also p. 1603.

PORTUGUESE INDIA

TABLE 94.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949
Iron ore	(1)	151,00
Manganese ore (exports)	4,728	(1)
Salt (exports)	10,719	(1)

[1] Data not available.

QATAR

Production of crude petroleum in Qatar totaled 750,000 barrels in 1949. None was produced in 1948.

SAUDI ARABIA

TABLE 95.—Mineral production, 1948–49

Mineral [1]	1948	1949
Gold (troy ounces)	74,000	67,200
Petroleum, crude (thousand barrels)	142,853	174,008

[1] Silver is produced, but data are not available. See also p. 1603.

SYRIA AND LEBANON

TABLE 96.—Mineral production, 1948–49, in metric tons

Mineral	1948	1949	Mineral	1948	1949
Cement, hydraulic	258,052	284,632	Gypsum	*1,000	1,400
Coal: Lignite	(1)	(2)	Salt [3]	*30,000	(2)

[1] Less than 1,000 tons.
[2] Data not available.
[3] Syria only. Salt is also produced in Lebanon, but data are not available. See also p. 1603.

THAILAND

TABLE 97.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	85	213	Tin (long tons)	4,240	7,815
Cement, hydraulic	82,800	127,200	Tungsten concentrates, 60 percent WO_3 basis	495	742
Gypsum	200	154			

[1] Salt is produced, but data are not available. See also p. 1603.

TURKEY (IN ASIA AND EUROPE)

TABLE 98.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	520	420	Iron ore	185,434	216,043
Asbestos	203	170	Iron and steel:		
Cement, hydraulic	344,924	372,584	Pig iron and ferro-alloys	166,467	112,760
Chromite	285,353	434,117	Steel ingots and castings	98,000	*118,000
Coal:			Lead		168
Bituminous (thousand tons)	2,669	2,705	Magnesite	3,407	4,870
Lignite (thousand tons)	829	*927	Manganese ore	8,227	16,702
Coke	337,471	234,500	Petroleum, crude (thousand barrels)		95
Copper:			Pyrites, including cupreous pyrites	(2)	
Mine	12,367	13,130	Salt	*236,905	*263,000
Smelter	10,979	11,283	Sulfur, native (long tons)	2,369	2,995
Fuel briquets	7,426	40,102			

[1] Arsenic and silver are produced, but data are not available. See also p. 1603.
[2] Data not available.

U. S. S. R. (IN ASIA)

Data on output of U. S. S. R. in Asia are included with those of U. S. S. R. in Europe.

OCEANIA

AUSTRALIA

TABLE 99.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949
Antimony	170	[2] 40
Arsenic, white, smelter	520	[3] 69
Asbestos	1,348	[4] 446
Barite	3,831	([5])
Bauxite	5,736	[2] 4,093
Beryllium concentrates	56	21
Bismuth (kilograms) [6]	*4,000	([5])
Cadmium, smelter (kilograms)	293,638	[7] 157,488
Cement, hydraulic [8]	643,097	1,076,302
Chromite	----------	([5])
Coal:		
Bituminous (thousand tons)	15,019	[4] 13,516
Lignite (thousand tons)	6,800	[4] 5,713
Cobalt	15	([5])
Copper:		
Mine	12,567	12,500
Smelter	11,572	10,192
Feldspar [9]	9,767	3,538
Fluorspar	520	568
Gold (troy ounces)	890,805	896,872
Graphite	234	[4] 52
Gypsum	280,853	[4] 207,874
Iron ore	2,076,979	[2] 772,194
Iron and steel:		
Pig iron and ferro-alloys [10]	1,255,405	1,058,000
Steel ingots and castings [10]	1,176,439	1,188,000
Lead:		
Mine	207,776	203,445
Smelter	162,057	185,300
Magnesite	32,962	[4] 2,641
Manganese ore	3,502	([5])
Mica	427	733
Molybdenum	2	3
Petroleum, crude (thousand barrels)	----------	1
Phosphate rock	2,170	([5])
Platinum-group metals: Osmiridium (troy ounces)	92	([5])
Potassium salts:		
Alunite (equivalent K_2O)	53	([5])
Alunitic mud (equivalent K_2O)	652	[7] 400
Pyrites, including cupreous pyrites	90,848	[4] 57,726
Salt	264,173	[4] 84,615
Silver (troy ounces)	10,057,519	9,849,213
Talc and soapstone	6,186	([5])
Tin:		
Mine (long tons)	1,874	1,973
Smelter (long tons)	1,885	1,955
Titanium concentrates:		
Ilmenite [11]	11,807	[4] 7,351
Rutile [11]	13,521	[4] 8,949
Tungsten concentrates, 60 percent WO_3 basis	1,234	*1,388
Zinc:		
Mine	151,681	153,000
Smelter	82,617	82,255

[1] Coke, fuel briquets, diamonds, and peat are produced, but data are not available. See also p. 1603.
[2] Excluding New South Wales.
[3] January to June, inclusive.
[4] Incomplete data.
[5] Data not available.
[6] Partly estimated; excludes content of some bismuth-tungsten concentrates.
[7] January to September, inclusive.
[8] Excluding Queensland, South Australia, and Tasmania.
[9] Includes some china stone.
[10] Data for fiscal year ended June 30 of year stated.
[11] Excludes content of beach sand in stock dumps.

FIJI ISLANDS

TABLE 100.—Mineral production, 1948–49

Mineral	1948	1949
Gold (troy ounces)	93,059	104,036
Silver (troy ounces)	29,187	29,755

FRENCH OCEANIA

Exports of phosphate rock from French Oceania (Makatéa Island, Tuamotu Archipelago) totaled 183,104 metric tons in 1948 and 239,532 tons in 1949.

NAURU AND OCEAN ISLANDS

Exports of phosphate rock from Nauru Island were 544,298 metric tons in 1948 and 802,070 tons in 1949. Exports of phosphate rock from Ocean Island were 126,854 metric tons in 1948 and 265,087 tons in 1949.

NEW CALEDONIA

TABLE 101.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Chromite	75,021	*75,000	Gypsum	779	17,119
Coke	--------	(2)	Nickel	4,882	3,371

[1] Iron ore and phosphate rock are produced, but data are not available. See also p. 1603.
[2] Data are not available.

NEW GUINEA TERRITORY [3]

TABLE 102.—Mineral production, 1948–49

Mineral	1948	1949
Gold (troy ounces)	86,556	95,100
Silver (troy ounces) [1]	31,739	(2)

[1] Fiscal year ended May 31 of year following that stated.
[2] Data not available.

NEW ZEALAND

TABLE 103.—Mineral production, 1948–49, in metric tons

Mineral [1]	1948	1949	Mineral [1]	1948	1949
Antimony	4	(2)	Magnesite	549	(2)
Arsenic, white, smelter	8	(2)	Manganese ore	533	(2)
Asbestos	--------	(2)	Mercury (flasks)	--------	(2)
Cement, hydraulic	247,205	254,039	Petroleum, crude (thousand barrels)	2	7
Coal:			Phosphate rock	--------	(2)
Bituminous and anthracite (thousand tons)	968	937	Platinum (troy ounces)	--------	(2)
Lignite (thousand tons)	1,853	1,874	Silver (troy ounces)	232,563	232,500
Fuel briquets	13,113	(2)	Talc and soapstone	--------	(2)
Gold (troy ounces)	93,903	84,856	Tungsten concentrates, 60 percent WO_3 basis	28	28
Iron ore	4,853	(2)			

[1] Coke, pig iron, and mica are produced, but data are not available. See also p. 1603.
[2] Data not available.

PALAU ISLANDS

Exports of phosphate rock from Angaur Island were 68,493 metric tons in 1948 and 140,221 tons in 1949. The destination was Japan. Peak exports of bauxite from Babelthuap Island were 135,669 metric tons in the year ended March 31, 1943, but there was no output in 1946–49.

PAPUA

Papua may have produced gold and manganese ore in 1948–49 and platinum in 1949, but data are not available. No platinum was produced in 1948.

[3] Western New Guinea is part of Indonesia, and southeastern New Guinea is Papua.

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By Mabel E. Winslow

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